VERIFICATION

I, Hanae SASADA, residing at Hyogo, Japan, state: that I know well both the Japanese and English languages; that I translated, from Japanese into English, the priority document as filed in the U.S. Patent Application No. 10/751,730, filed on January 6, 2004, which is a continuation application of PCT/JP02/07012, filed on July 10, 2002; and that the attached English translation is a true and accurate translation to the best of my knowledge and belief.

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Description

MOBILE DEVICE COMMUNICATIONS SYSTEM AND METHOD

Technical Field

The present invention relates to a communications system and a communications method using a network, and more specifically to a mobile device communications system and method which are provided with a plurality of service providing servers and perform communications using a mobile terminal.

Background Art

FIG. 33 is a block diagram of the system configuration of the conventional technology of the mobile device communications system, for example, a mobile device packet network. In FIG. 33, the user of the system, that is, a client, performs communications between mobile devices or with a plurality of service providing servers using mobile devices (MS) 100a, 100b, ..., for example, a mobile phone.

In FIG. 33, a mobile device packet network includes, for example, a mobile IP (Internet protocol) network 101, a network access device (NAS) for performing a process corresponding to the access gained by each of mobile devices (MS) 100a, 100b, ... to the mobile IP network 101, or foreign agents (FA) 102a, 102b, ..., routers (R) 103a, 103b, and 103c connected to the input/output point of the service providing server of the network 101, a user authentication device 104 connected to the routers, load balancers (L. B.) 105a, 105b, and 105c connected to each router, a local area network or wide area network (LAN/WAN) 106 for connection of these load balancers with a plurality of service providing servers, and a home agent (HA) 107 on a mobile IP network.

A plurality of service providing servers form a group configured by a plurality of servers for providing the same services. For example, service providing servers 110a, 110b, 110c, ... are configured by servers capable of providing the same services as a group. Therefore, for example, servers of a group configured by service providing servers 111a, 111b, 111c, ... and servers of a group configured by service providing servers 112a, 112b, 112c, ... provide different services.

In the mobile device packet network shown in FIG. 33, communications are performed between the mobile devices, for example, a mobile phone and a service providing server, as described above. Since a server capable of providing a service requested by a client forms a group as described above, a load balancer for processing an input packet from a client is provided at a stage before the service providing server such that input packets can be distributed to the service providing servers in accordance with the balancing policy by which the loads of the servers can be balanced. This is called load balancing.

In the common load balancing system, a grouped service providing server is assigned representative address information, a client transmits a packet using the representative address information as a destination, and the packet is distributed to any service providing server in the group based on the balancing policy of the load balancer.

The balancing policy can be a round robin policy, a weighted round robin policy, a priority policy, a minimum number of connections policy, a fastest response time policy, a CPU load policy, etc. A balancing policy information table indicating the above-mentioned balancing policies is provided for the load balancer.

For example, in a mobile device packet network operated by a common carrier for providing a communications

service, there are a large number of users, and a plurality of routers 103a, 103b, and 103c and load balancers 105a, 105b, and 105c are provided at the input/output point of the service providing servers of the mobile IP network 101 shown in FIG. 33 to distribute the users, thereby performing load balancing for a number of service providing servers.

However, with the above-mentioned configuration, when a mobile device, for example, a mobile phone 100a moves during the communications, the input/output point of the service providing server to the mobile IP network 101 dynamically changes. For example, communications are first performed through the router 103a, the load balancer 103c and the load balancer 105c.

In such a case, for example, when the three load balancers 105a, 105b, and 105c perform load balancing based on the respective balancing policies, a packet can be distributed to different service providing servers in the same group. In this case, there can be the problem that a TCP connection, that is, a connection for reception of a specific service, cannot be maintained.

Furthermore, in the above-mentioned case, for example, although the load balancers 105a and 105c distribute packets to the same service providing server in the group, the packets do not pass through the same path between the mobile IP network 101 and the service providing servers if, for example, the mobile device 100a transmits an up packet, that is, a packet to a service providing server, moves during reception of a down packet, that is, a packet from a service providing server, and the up packet after the movement passes through the different load balancer, thereby causing the following five problems.

The first problem is that it requires a long time to switch services. The management of a TCP connection corresponding to one service is to be performed on the

service providing server side, and a TCP connection is to be reconnected each time a service is switched as viewed from the mobile device side, thereby requiring a long time to switch the service.

The second problem is that it can not balancing a risk when a service providing server goes down. If a service providing server which manages a TCP connection goes down, the connection cannot be switched to the server for providing the same services, and services cannot be provided until the faulty service providing server recovers from the fault.

The third problem is that proxy accounting information can not be generated. That is, only the service providing server which manages the TCP connection can perform an authenticating process in a contract service unit in providing a service for a client, and no proxy generation of accounting information can be performed for pay contents.

The fourth problem is that protocol conversion of a transport layer can not be performed between a wireless network and a cable network. There is a difference in delay time, etc. between a wireless network and a cable network. Therefore, to set a standard Internet service in the optimum format in the wireless communications, it is necessary to convert a window size (the amount of data which can be transmitted at a time), etc., that is, a protocol conversion of a transport layer between the wireless network and the cable network. If packets are not transmitted through the same path, a trunk device for protocol-converting a transport layer cannot be provided.

The fifth problem is that no gateway function between the network of the Internet protocol version (IPV) 4 and the network of the IPV6 can be provided. Recently, with an increasing number of mobile phones, large expansion of IP addresses is required, and there are plans to implement

IPV6. When IPV6 is implemented, a gateway function will be required between the current IPV4 network and the IPV6 network. However, when packets are not transmitted through the same path, the gateway function cannot be provided.

The present invention has been developed to solve the above-mentioned problems, and aims at setting the same path for packets which configure, for example, the same TCP connection although a plurality of input/output points are provided on the service providing server side of an IP network and a load balancer is provided for each input/output point, and maintaining a TCP connection although a mobile device performs communications while it moves. Another object of the present invention is to provide a gateway function in the path to avoid the necessity for making time for switching services, balance a risk when the service providing server goes down, perform proxy generation of accounting information, and perform a transport layer protocol conversion, and further realize a gateway function between the IPV4 network and the IPV6 network.

Disclosure of the Invention

FIG. 1 is a block diagram of the configuration showing the principle of the mobile device communications system according to the present invention. FIG. 1 is a block diagram of the configuration showing the principle of the communications system which is provided with service providing servers 7a, 7b, ..., 8a, 8b, ... and allows mobile terminals 1a, ..., 1n to establish communications.

In FIG. 1, the mobile terminals 1a, ..., 1n are connected to first network means 2 having a plurality of input/output points to a service providing server, and can be, for example, a mobile IP network.

A plurality of first communication distribution means 3a, 3b, ... are, for example, load balancers, and are

connected to each of the plurality of input/output points of the first network means 2.

Second network means 4 is a network to which the first communication distribution means 3a, 3b, ... are connected, and can be, for example, a local area network or a wide area network.

Third network means 5 is a network to which the plurality of service providing servers 7a, 7b, ..., 8a, 8b, ... are connected, and can be, for example, a local area network or a wide area network.

A plurality of second communications distribution means 6a, 6b, ... are connected between the second network means 4 and the third network means 5, distributes a series communications between a mobile terminal and a service providing server to any of the plurality of service providing servers, and can be, for example, a packet gateway device.

Then, the first communication distribution means 3a, 3b, ... are configured to distribute a series of communications between a mobile terminal and a service providing server to any of a plurality of second communications distribution means 6 through the second network means 4.

According to an embodiment of the present invention, the system further comprises session management means for assigning an identifier to a session which is a series of communications between a mobile terminal and a service providing server, and managing the identifier. Each of the first communication distribution means 3a, 3b, ... further comprises same storage contents destination storage means for storing any of the second communications distribution means 6a, 6b, ... for distributing a series of communications corresponding to the identifier of a session as the series of communications between a mobile terminal and a service providing server.

According to an embodiment of the present invention, a plurality of service providing servers configure a plurality of groups each being configured by servers which provide the same services, the mobile terminal specifies a representative address for each of the plurality of groups, and establishes communications to and from a service providing server, and the second communications distribution means 6a, 6b, ... can distribute a series of communications to any of the service providing servers in the group specified by the representative address. In this case, when the mobile terminal changes the representative address to switch a service to be received in a series of communications, the second communications distribution means 6a, 6b, ... can distribute the subsequent communications in the series of communications to any of the service providing servers in the group specified by the representative address after the change, and continue the series of communications.

Furthermore, according to an embodiment of the present invention, when the second communications distribution means 6a, 6b, ... distribute a series of communications to any of the plurality of service providing servers, the system can further comprise service authentication means for authenticating the qualification of a user of a mobile terminal for a service provided by the service providing server.

Furthermore, according to an embodiment of the present invention, the second communications distribution means 6a, 6b, ... can also distribute a series of communications not only to a plurality of service providing servers, but also to a server outside the mobile device communications system. The mobile device communications system can further comprise accounting information generation means for generating accounting information for a service received by the mobile terminal from a service

providing server or a server outside the mobile device communications system.

In a mobile device communications method according to the present invention, a mobile terminal can transmit a packet in a series of communications by specifying any of a plurality of service providing servers, a load balancer which receives the packet can distribute the packet to any of the plurality of packet gateway devices corresponding to an identifier for the series of communications, and the packet gateway device to which the packet is distributed can distribute the packet to any of the plurality of service providing servers which provide the same services as the service providing server specified by the mobile terminal. The load balancer corresponds to the first communications distribution means, and the packet gateway device corresponds to the second communications distribution means.

In this method, a packet (down packet) in a series of communications from the service providing server to the mobile terminal is transmitted first from the service providing server to the packet gateway device which has distributed a packet (up packet) from the mobile terminal to the service providing server, transmitted from the packet gateway device to the load balancer which has distributed the up packet, and finally transmitted to the mobile terminal.

In addition, according to the present invention, a portable computer-readable storage medium is used by a computer forming the packet gateway device, and stores a program used to direct the computer to perform the steps of: storing a destination address and a source address of a packet received from the load balancer using a unique source port number as a key; setting the unique source port number as a source port number of a packet header; selecting a plurality of service providing servers capable

of providing a service requested by a mobile terminal from among a plurality of service providing servers so that the selected service providing server can share the load; and setting the addresses of the selected service providing servers as destination addresses and the address of the apparatus as a source address, and transmitting a packet to the service providing server. When the mobile terminal moves and the corresponding network access device is switched, the mobile terminal has the link of the PPP temporarily suspended. However, the PPP protocol stack does not notify the TCP protocol stack of the suspension, thereby preventing the TCP connection from being disconnected.

Also used as a storage medium by the computer forming the packet gateway device is a portable computer-readable storage medium storing a program used to direct a computer to perform the steps of: retrieving mobile device identification information about the mobile terminal as a source of the packet received from the load balancer; retrieving the destination address of the received packet; and determining whether or not the service provided by the service providing server of the destination address can be provided for the user of the mobile terminal according to the mobile device identification information and the destination address.

Furthermore, used as a storage medium by a computer forming the packet gateway device, there is also a portable computer-readable storage medium storing a program used to direct the computer to perform the steps of: retrieving the destination address and the source address of a packet received from a load balancer, and setting them in an accounting record when a series of communications between a mobile terminal and a service providing server start; incrementing the number of packets of an accounting record each time a packet is received from the load balancer until

the series of communications terminate; retrieving a packet length from the received packet, and adding the packet length to the packet length of the accounting record; and changing the source address in the accounting record into the identification information about the user of the mobile terminal, and the destination address into the information about the service providing server when a series of communications terminate.

Used by a computer forming the packet gateway device is a program used to direct the computer to perform the procedures of: storing the destination address and the source address of the packet received from a load balancer using a unique source port number as a key; selecting means for setting the unique source port number as a source port number of a packet header, and a plurality of service providing servers capable of providing a service requested by a mobile terminal from among a plurality of service providing servers so that the loads of the service providing servers can be balanced; and setting the address of the selected service providing server as a destination address, and the address of the apparatus as a source address, and transmitting the packet to the service providing server.

Used as a program by the computer forming the gateway device is a program used to direct a computer to perform the procedures of: retrieving mobile device identification information about the mobile terminal as a source of the packet received from the load balancer; retrieving the destination address of the received packet; retrieving the destination address of the received packet; and determining whether or not the service provided by the service providing server of the destination address can be provided for the user of the mobile terminal according to the mobile device identification information and the destination address.

Furthermore, used by a computer forming the packet gateway device, there is also a program used to direct the computer to perform the procedures of: retrieving the destination address and the source address of a packet received from a load balancer, and setting them in an accounting record when a series of communications between a mobile terminal and a service providing server start; incrementing the number of packets of an accounting record each time a packet is received from the load balancer until the series of communications terminate; retrieving a packet length from the received packet, and adding the packet length to the packet length of the accounting record; and changing the source address in the accounting record into the identification information about the user of the mobile terminal, and the destination address into the information about the service providing server when a series of communications terminate.

As described above, according to the present invention, a plurality of packet gateway devices are provided between the load balancer and a plurality of service providing servers provided at a plurality of input/output points of the network to which a mobile device is connected, and a series of communications of packets between one of a mobile device and service providing servers can be performed constantly through the same packet gateway device.

Brief Description of the Drawings

FIG. 1 is a block diagram of the configuration showing the principle of the mobile device communications system according to the present invention;

FIG. 2 is a block diagram of the system configuration of a mobile device packet network according to an embodiment of the present invention;

FIG. 3 shows the sequence of the processes between

the apparatuses when a session starts;

FIG. 4 is a block diagram of the configuration of the user authentication device;

FIG. 5 shows an example of a flowchart of the address assigning process by the user authentication device;

FIG. 6 shows a packet format according to an embodiment of the present invention;

FIG. 7 shows an example of the data of the address information table in the user authentication device;

FIG. 8 shows an example of the data of the user information table in the user authentication device;

FIG. 9 is a block diagram of the configuration of the session management device;

FIG. 10 shows an example of the data of the session information table;

FIG. 11 shows the state transition of a session state;

FIG. 12 is a block diagram of the configuration of the load balancer;

FIG. 13 shows an example of a flowchart of the load balancing process by the load balancer;

FIG. 14 shows an example of the data of the balancing policy information table in the load balancer;

FIG. 15 shows an example of a data format of the packet header;

FIG. 16 shows the configuration of the packet gateway device;

FIG. 17 is a flowchart (1) of the up packet distributing process by the packet gateway device;

FIG. 18 is a flowchart (2) of the up packet distributing process by the packet gateway device;

FIG. 19 is a flowchart (3) of the up packet distributing process by the packet gateway device;

FIG. 20 is a flowchart (1) of the down packet distributing process by the packet gateway device;

FIG. 21 is a flowchart (2) of the down packet distributing process by the packet gateway device;

FIG. 22 shows an example of the data of the address information storage table in the packet gateway device;

FIG. 23 shows an example of the data of the balancing policy information table in the packet gateway device;

FIG. 24 shows the address conversion by the packet gateway device;

FIG. 25 is a flowchart of the service authenticating process by the packet gateway device;

FIG. 26 shows an example of the data of the service order information table in the packet gateway device;

FIG. 27 shows an example of the data of the service providing server information table in the packet gateway device;

FIG. 25 is a flowchart of the proxy accounting information process by the packet gateway device;

FIG. 29 shows an example of the data of the accounting record generated by the packet gateway device;

FIG. 30 shows a sequence of the processes performed between the apparatuses by the user log out when a session terminates;

FIG. 31 shows a sequence of the processes performed between the apparatuses in a dormant state;

FIG. 32 shows loading a program to a computer to realize the present invention; and

FIG. 33 is a block diagram of the configuration according to the conventional technology of a mobile device packet network.

Best Mode for Carrying Out the Invention

FIG. 2 is a block diagram of the system configuration of the mobile device packet network according to an embodiment of the present invention. In this system, mobile devices (MS), for example, mobile phones 20a,

20b, ... are connected to, for example, a mobile IP network 21 through network access devices (NAS) or foreign agents (FA) 22a, 22b, ... by wireless or cable.

There is a plurality of, for example, three input/output points on the service providing server side of the network 21, and the input/output points are respectively connected to routers (R) 23a, 23b, ... and load balancers (L. B.) 25a, 25b, ... as shown in FIG. 2. The load balancers (L. B.) are connected to a local area network or wide area network (LAN/WAN) 26.

The system is provided with a user authentication device 24 for managing users and a session management device 27 for managing the session of the transmission/reception of a series of packets from the access of, for example, a mobile device to the mobile IP network 21 to the completion of necessary communications. The user authentication device 24 is connected to, for example, the routers 23a, 23b, ... of the input/output points of the network 21 on the service providing server side, and is also connected to the session management device 27.

The session management device 27 and a plurality of packet gateway (GW) devices 28a, 28b, ... are connected to the local area network or wide area network (LAN/WAN) 26 to which the load balancers (L. B.) 25a, 25b, ... are connected. These packet gateway devices have the most significant functions in the embodiments of the present invention as described later.

Each packet gateway device is connected by a number of service providing servers and LAN/WAN 29. It is assumed that a number of service providing servers respectively belong to same groups. For example, service providing servers 30a, 30b, ... make a group, and the servers in the group are to provide the same services, and the mobile devices establish communications using the representative

address of the group as described later. For example, service providing servers 31a, 31b, ... provide services different from those provided by service providing servers 32a, 32b, ...

FIG. 3 shows the sequence of the processes performed among apparatuses when a session starts in the system shown in FIG. 2. The sequence of the processes shown in FIG. 3 are performed among the mobile device 20, the network access device 22, the load balancer 25, the user authentication device 24, the session management device 27, the packet gateway device 28, and the service providing server 30.

The packet format and the packet sequence of the packet communications among the mobile device 20, the network access device 22, and the user authentication device 24 are in accordance with the protocol suggested in the diameter mobile IP extensions of the Internet draft, and the detailed explanation is omitted here.

On the other hand, the packet sequence and the packet format among the user authentication device 24, the session management device 27, and the packet gateway device 28 are processed regardless of the provisions, and are specific to the present embodiment.

In FIG. 3, in accessing the mobile IP network 21 from the mobile device 20, the network access device 22 transmits an access request prescribed by the above-mentioned protocol to the user authentication device 24.

FIG. 4 is a block diagram of the configuration of the user authentication device. The user authentication device is configured by a LAN driver unit or a WAN driver unit 41, a TCP/IP protocol handler unit 42, a communications control unit 43, a user management unit 44, and a server monitor unit 45, and further provided with an address information table 46 managed by the user management unit 44 and the server monitor unit 45, and a user information table 47

managed by the user management unit 44. A LAN or a WAN connected to the LAN driver unit or a WAN driver unit 41 corresponds to the network 26 connected through the session management device 27 as shown in FIG. 2, or the mobile IP network 21 connected through the routers 23a, 23b, ...

The TCP/IP protocol handler unit 42 includes a user datum protocol and all of the TCP/IP protocol set.

FIG. 5 is a flowchart of the address assigning process of the user authentication device. In this process, the process of assigning or retrieving an IP address to the session to be or already started in response to the access request received from the network access device 22 is performed.

When the process is started as shown in FIG. 5, first in step S1, an access request packet from the network access device 22 is received, and a session information retrieval packet is transmitted in step S2 by the user management unit 44 to the session management device 27 as shown in FIG. 3. In step S3, a session information retrieval reply packet is received from the session management device 27.

FIG. 6 shows the packet format of a packet to be explained later in addition to the session information retrieval packet and the session information retrieval reply packet. The session information retrieval packet stores the type of session information retrieval as a packet type after the TCP/IP header, and stores mobile device identification information as trailing information in the packet. The mobile device identification information corresponds to an identifier, and not a phone number, for identifying each mobile device. This identification information is assumed to be retrieved from, for example, an access request packet.

The session information retrieval reply packet stores a TCP/IP header, a session information retrieval reply

indicating a packet type, mobile device identification information (identifier), a retrieval result indicating whether or not there is a record of a session corresponding to the mobile device identifier, and, if there is the record, an IP address assigned to the session.

Back in FIG. 5, it is determined in step S4 whether or not there is a new connection. In a new connection, the session information table does not store the record of the session corresponding to the mobile device identifier. In this case, an address to be assigned is determined in step S5.

The determination is described in detail in steps S10 through S16 shown on the right side of FIG. 5. In order to balance the load, the record having the number of addresses in the smallest address range assigned in the address information table 46 is retrieved, an address to be assigned is determined, and an access accept packet is transmitted to the network access device 22 in step S6, thereby terminating the process.

If it is not a new connection in step S4, that is, if a session corresponding to the mobile device identifier has been entered in the session information table, then the IP address corresponding to the session is used as is in step S7, and the access accept packet is transmitted in step S6, thereby terminating the process.

As described above, a session refers to the transmission/reception of a series of packets up to the user log-out by a mobile device using an IP address assigned by the user authentication device 24. Therefore, when a user is provided with different services in a session, a plurality of TCP connections corresponding to each service are contained in the session.

FIG. 7 shows an example of the storage data of the address information table 46. In FIG. 7, the distribution range of an IP address assigned to a mobile device

basically corresponding to a session is stored with the load balancing of the packet gateway devices 28a, 28b, ... shown in FIG. 2 taken into account. For example, when the load is equally balanced, the distribution range is determined such that the number of addresses in the distribution range can be equal.

Therefore, the address information table 46 stores the distribution range of the IP address, the number of assigned IP addresses in the range, the operation state as to whether or not each packet gateway device is being operated, and the address of the user information table as a pointer to the user information table 47 storing an IP address assigned corresponding to each packet gateway device, etc.

FIG. 8 shows an example of the stored data in the user information table 47. In FIG. 8, a user identifier, a password, mobile device identification information, and a phone number are stored as user identification information corresponding to the four IP addresses already assigned in the IP address distribution range for the packet gateway device Pgw2 shown in FIG. 7.

Back in FIG. 5, the details of the process in step S5, that is, the processes in steps S10 through S16 are described below. When the process is started, the subsequent steps S11 and S12 are checked in step S10 on each record of the address information table.

In step S11, it is determined whether or not the number of pieces of already assigned address information is the smallest. If the smallest number can be detected, then it is determined in step S12 whether or not the operation state of the packet gateway device corresponding to the record is normal, that is, being operated. If it is normally operated, then control is passed to step S13. If it is not being operated, the processes in and after step S10 are repeated.

That is, it is determined whether or not the packet gateway device corresponding to the second smallest number of already assigned IP addresses is being operated. If it is being operated, then control is passed to the processes in and after step S13.

In step S13, the address of the user information table corresponding to the address distribution range of the retrieved record, that is, the IP address assigned by the pointer is retrieved, the address not assigned in the distribution range is retrieved in step S14, the record corresponding to the IP address is added to the user information table in step S15, the number of assigned IP addresses of the records of the packet gateway device corresponding to the IP address added in the address information table is incremented in step S16, thereby terminating the process.

FIG. 9 is a block diagram of the configuration of the session management device 27 shown in FIG. 2. In FIG. 9, the session management device comprises a LAN driver unit or a WAN driver unit 51, a TCP/IP protocol handler unit 52, a communications control unit 53, a session management unit 54, and a session information table 55 managed by the session management unit 54.

FIG. 10 shows an example of data stored in the session information table 55. In FIG. 10, the session information table 55 stores a session identifier, a mobile device identifier, an assigned IP address, and a session state of "Act" indicating "in session" corresponding to each of sessions which have been already started .

The session management unit 54 of the session management device searches the session information table using the mobile device identification information as a key when it receives a session information retrieval packet from the user authentication device 24 as shown in FIG. 3, and returns the result as a session information retrieval

reply packet explained by referring to FIG. 6 to the user authentication device 24.

Based on the reply, the user management unit 44 of the user authentication device sets a new IP address or an already assigned IP address as access accepted, and transmits it to the network access device 22.

The user authentication device 24 assigns an IP address in the process according to the flowchart shown in FIG. 5 to perform load balancing of the packet gateway device being operated as described above each time it receives an access request. Whether or not the packet gateway device is being operated is monitored by the server monitor unit 45 of the user authentication device as a health check at, for example, predetermined intervals, and the monitored state is stored in the address information table.

After the assignment of the IP address, the user authentication device 24 receives an account start from the network access device 22, transmits a session information entry packet from the user management unit 44 to the session management device 27, and transmits a session start notification packet to the packet gateway device 28 corresponding to the assigned IP address.

The packet formats of the session information entry packet and the session start notification packet are shown in FIG. 6. In FIG. 6, the session information entry packet stores data, that is, a header, a session information entry as a packet type, mobile device identification information, and an IP address in this order, and the session start notification packet stores a header, a session start notification as a packet type, and an IP address.

The session management unit 54 of the session management device shown in FIG. 9 enters in the session information table 55 a record corresponding to a new session when it is started, and sets the session state as

"Act". A session information table is also provided in the packet gateway device described later, and the contents are the same as those shown in FIG. 10. The session management unit in the packet gateway device also enters the record corresponding to a new session.

The session management device 27 performs session state management through the session management unit 54 during the period from the reception of a session information entry packet from the user authentication device 24 to the reception of a status change (close) described later. In this session state management, the session state is managed as one of the four states, that is, "None" indicating that the session has not been entered yet, "Act" indicating in-session, "Dormant" indicating a non communications in a predetermined period, and "Close" indicating the session termination state.

FIG. 11 shows the state transition of a session state managed by the session management device. In FIG. 11, when a session is started in response to the session information entry by the user authentication device 24, the session information indicates "Act" as shown by ①. In this state, the dormant timer described later times out, and upon receipt of a status change (stop) from the user authentication device 24 as shown by ②, the session status changes into "Dormant".

Otherwise, as described later, for example, when a user terminates the communications, that is, when a status change (close) in response to the user log-out is received from the user authentication device 24, the session status changes into "Close" as shown by ③ in FIG. 11.

Although not directly related to the present invention, the mobile device packet network constantly monitors whether or not the communications with a mobile device can be performed, which is called "interim" monitor. If the communications with the mobile device can be

performed, then information that the communications can be performed for relatively long intervals, for example for 30-minute intervals, is transmitted to the network access device 22 shown in FIG. 2. The information is transmitted as a status change (interim) from the user authentication device 24 to the session management device 27. When the information is valid, the session state maintains "Act" as shown by ⑥ in FIG. 11. If a timeout of the interim monitor timer occurs before the status change (interim) is input from the user authentication device 24, then session status changes from "Act" to "Close" as shown by ⑧ in FIG. 11.

When the session state becomes "Dormant", the session timer is activated as described later. If a packet from a user to a service providing server is input to the network before the timeout of the session timer occurs, then the user authentication device 24 inputs a status change (start) as shown by ⑤ in FIG. 11, and the session state becomes "Act" again.

When a timeout of the session timer occurs when the session state indicates "Dormant", the session status changes from "Dormant" to "Close" as shown by ⑦ in FIG. 11. Furthermore, for example, when the user terminates the communications as described above, a status change (close) is input from the user authentication device 24 as shown by ③, and the session status changes into "Close".

When the session state becomes "Close" and the session log indicating the data of the session is output, the session status changes from "Close" to "None" as shown by ④ in FIG. 11. When the session log is output, the corresponding record in the session information table which is changed into "Close" is output to the log file, and the entry is deleted.

Described below is the operation of the load balancer (L. B.) 25 shown in FIG. 2. FIG. 12 is a block diagram of the configuration of the load balancer. In FIG. 12, the

load balancer comprises a LAN driver unit or a WAN driver unit 61, an address conversion unit 62, a load balancing control unit 63, a server monitor unit 64, a load balancing policy management unit 65, and a balancing policy information table 66 managed by the load balancing policy management unit 65.

As shown in FIG. 2, the load balancer (L. B.) determines to which of the plurality of packet gateway devices 28a, 28b, ... the data packet transmitted from the mobile device is distributed to. The L. B. transmits the data packet through the local area network or wide area network (LAN/WAN) 26, and rewrites the address portion of the packet for the transfer of the packet, thereby performing load balancing for the packet gateway device.

The load balancer analyzes the communications protocol of the passing packet, and changes the state of the TCP connection, that is, "connected", "unconnected", "wait for connection", etc., for example, from "unconnected" to "connected" for the connection-oriented protocol (TCP protocol), thereby managing the TCP connection.

When a connection is made, a packet gateway device to which a packet is to be distributed is determined based on the contents of the balancing policy information table 66. The contents of the balancing policy information table 66 are the same in any of the load balancers (L. B.) 25a, 25b, ... shown in FIG. 2.

As shown in FIG. 3, the network access device 22 starts packet communications in which a user data packet from the mobile device 20 is transmitted to a service providing server after access acceptance from the user authentication device 24 is received. The load balancer provided on the route between the network access device 22 and the service providing server receives a user data packet and performs load balancing by distributing the

packet to any of a plurality of packet gateway devices.

FIG. 13 is a flowchart of the process performed by the load balancer. When the process is started as shown in FIG. 13, a packet is received by the access conversion unit 62 shown in FIG. 12 first in step S21. In steps S22 and S23, the process of retrieving a record whose source IP address of the received packet is in the address distribution range is performed on each record of the balancing policy information table 66.

FIG. 14 shows an example of the data stored in the balancing policy information table. In FIG. 14, as described above, the destination MAC address, the destination state, the substitute destination MAC address 1, and the destination state are stored corresponding to the distribution range of the IP address uniquely assigned to the session identification information and mobile device identification information.

The destination MAC address is an address of any of the packet gateway devices 28a, 28b, ... shown in FIG. 2, and the destination state shows whether or not the packet gateway is normally operating.

The substitute destination MAC address 1 is specified by the destination MAC address of the record. It is an address of a substitute packet gateway device to which the data packet having an IP address in the IP address distribution range of the record as a source address is to be distributed when the packet gateway goes down.

Although not shown in FIG. 14, when the packet gateway specified by the substitute destination MAC address 1 also goes down, the address of another substitute packet gateway can be stored.

Back in FIG. 13, when a record whose source IP address is in the address distribution range is retrieved in the processes in steps S22 and S23, it is determined in step S24 whether or not the state of the packet gateway

specified by the destination MAC address of the record is normal, that is, in operation. If it is normal, then the destination MAC address of the received packet is rewritten into the destination MAC address of the record in step S25, and the packet is transmitted to the packet gateway device having the rewritten MAC address in step S26, thereby terminating the process. The storage device, etc. of the MAC address in the packet is described later.

If the state of the packet gateway device specified by the destination MAC address is not normal in step S24, it is determined in step S27 whether or not the state of the packet gateway specified by the substitute destination MAC address 1 for the record is normal. If it is normal, the destination MAC address is rewritten into the substitute destination MAC address 1 in step S28 as in step S25, the packet is transmitted to the gateway device in step S26, thereby terminating the process.

Furthermore, when the state of the packet gateway device as the substitute destination is not normal in step S27, the received packet is rejected in step S29, thereby terminating the process. As a result, a packet is retransmitted in the case of the TCP connection. However, if one of the destination and substitute destination packet gateway devices is restored to a normal state, then the retransmitted packet is transmitted to the restored packet gateway, thereby continuing the normal process. If the packet gateway device remains abnormal, the retransmitted packet remains rejected, and finally the TCP connection is disconnected.

FIG. 15 shows an example of a data format of the TCP/IP packet. In FIG. 15, the portion corresponding to the Ethernet frame, that is, the IP header and the TCP header, are stored before the user data. The source IP address determined in step S23 shown in FIG. 13 is stored in the portion of the IP header, and the destination MAC

address rewritten in steps S25 and S28 is stored in the portion corresponding to the Ethernet frame. The above-mentioned data format is based on the following document.

Document) Internet Standard Quick Reference by Masami Nosaka, O'Reilly Japan

FIG. 16 is a block diagram of the configuration of the packet gateway device. As described above, the data packet communicated in a session between a mobile device and a service providing server in the system shown in FIG. 2 is communicated in the plurality of packet gateway devices 28a, 28b, ... constantly through the same packet gateway device, and the packet gateway device performs load balancing for the service providing server, and various processes such as the service authenticating process, the accounting process, etc. as the most important device in the present embodiment.

In FIG. 16, the packet gateway device comprises a LAN driver unit or a WAN driver unit 71, an address conversion unit 72, a TCP/IP protocol handler unit 73, a load balancing unit 74, a gateway control unit 75, a server monitor unit 76, a balancing policy management unit 77, a packet information collection unit 78 for collecting necessary information for accounting, an accounting attribute notification unit 79 for retrieving a necessary attribute for accounting from a data packet, a service authentication unit 80 for determining whether or not a service for a mobile device can be provided, a proxy reply unit 81 for notifying the mobile device that, for example, no services can be admitted, an accounting log edition unit 82 for editing an accounting log, a session management unit 83, a balancing policy information table 84 managed by the balancing policy management unit 77, an address information storage table 85 storing the necessary address for an address conversion of the address conversion unit, a session information table 85 managed by the session

management unit 83, a session information table 86 managed by the session management unit 83, a service order information table 87 referred to in a service authentication, etc., a service providing server information table 88, an accounting log database (DB) 89 storing an accounting log generated by the accounting log edition unit 82, and a distribution information table 90 storing a server to which a packet is actually distributed among the service providing servers capable of providing the same services corresponding to the TCP connection to the mobile device.

In FIG. 16, since the contents of the session information table 86 are the same as those of the session information table 55 in the session management device shown in FIG. 10. Although the balancing policy information table 84 has the same name as the balancing policy information table 66 in the load balancer, the contents relate to the balancing policy, to which of a plurality of service providing servers a packet is to be distributed, corresponding to each service type. Although an example of data is described later, the contents are different from those of the table shown in 14.

Furthermore, in FIG. 16, the TCP/IP protocol handler unit 73 and the gateway control unit 75, the gateway control unit 75 and the server monitor unit 76, and the server monitor unit 76 and the balancing policy management unit 77 are directly connected to each other.

FIGS. 17 through 21 are flowcharts of the packet distributing process performed by the packet gateway device. FIGS. 17 through 19 show the process performed on the packet from a mobile device to a service providing server, that is, an up packet. FIGS. 20 and 21 show the process performed on a down packet from a service providing server to a mobile device. These process flowcharts are described below by referring to FIGS. 22 and 23.

FIG. 22 shows an example of the data stored in the address information storage table 85 in the packet gateway device, and FIG. 23 shows an example of the data stored in the balancing policy information table 84. Before explaining the processes of the flowcharts shown in FIGS. 17 through 21, the contents stored in the tables are explained below first.

The address information storage table shown in FIG. 22 stores the source IP address, the source port number, the destination IP address, and the destination port number as the stored address information corresponding to the unique key information used in storing the source address, etc. stored in the packet in the process of rewriting the destination address of the packet, etc. in the packet gateway device as described later.

The balancing policy information table shown in FIG. 23 stores the representative IP address of the group of service providing servers depending on the provided service type, the number of actual servers, the IP addresses of actual servers, the service types in this embodiment, for example, the IP addresses of the actual server 1 and the actual server 2 as the addresses of the two service providing servers of the groups corresponding to mail and chats, and "normal" indicating that the state of the server indicating whether or not the server is being operated is "operating". As the balancing policy, two actual servers are used, for example, alternately to distribute packets.

FIGS. 17 through 19 are flowcharts of the process of distributing an up packet by the packet gateway device, that is, a packet transmitted to a service providing server from the mobile device (load balancing process for a service connecting server).

The packet gateway device also functions as a transparent proxy. As a TCP/IP system, the device in the network, for example, a proxy notifies an upper application

of only the MAC address of the packet gateway device on the Ethernet layer, and passes other addresses through the network. Furthermore, generally, an upper application is notified of the process of a packet having the destination IP address as an address of the packet gateway device in the MAC addresses of the packet gateway device, but the transparent proxy notifies the upper application of the reception of a packet after rewriting an IP address although the IP address is not addressed to the packet gateway device. In this case, the original IP address is stored in, for example, a table.

When the process is started as shown in FIG. 17, the address conversion unit 72 receives a packet first in step S31, and it is determined in step S32 whether or not the packet is a connecting packet of a new TCP connection, that is, a connection opening packet. If it is an opening (connection) packet, then the information about the destination address and the source address of the received packet is stored in the address information storage table 85 shown in FIG. 16 in step S33 using a unique source port number as a key.

Then, in step S34, the destination address is set as the address of the packet gateway device, the source port number is set as the above-mentioned unique key number, the packet is transmitted to the gateway setting unit 75 through the TCP/IP protocol handler unit 73, the TCP/IP protocol process is performed in step S35, and it is determined in step S36 whether or not the packet is a connection opening (connecting) packet.

If it is an opening packet, the gateway control unit 75 retrieves the destination address information from the address information storage table 85 in step S37 using the source port number of a packet as a key, and the TCP/IP protocol handler unit 73 is requested to perform the normal TCP connection process on the service providing server

based on the destination address in step S38 shown in FIG. 18.

In step S39, the TCP/IP protocol process is performed. In step S40, the load balancing unit 74 refers to the balancing policy information table 84. In step S41, it is determined whether or not the destination address is a representative address of a plurality of service providing servers for providing the same services. If it is a representative address, then it is determined in step S42 whether or not it is a connection opening (connecting) packet. If it is an opening packet, then a service providing server is selected in step S43 according to a balancing policy such as a round robin system, etc., and the actual address information is set as the destination address of a packet.

Then, in step S44 shown in FIG. 19, the actual address of the selected server is stored in the distribution information table 90 using the source port number as a key, and it is determined in step S45 whether or not a disconnection reply (fin ack) which is a normal disconnection request for a TCP connection or an abnormal disconnection request (reset) is being transmitted to the server. In this example, since the packet is a connection opening packet, the address of the packet gateway device is set as the source address in step S46, and the packet is transmitted to the service providing server, thereby terminating the process. Since the address of the packet gateway device is set as the source address, a down packet from the service providing server to the mobile device is transmitted to the packet gateway device which has transmitted an up packet. The processes in steps S45 and S57 are performed for the disconnecting process on the TCP connection because the TCP connection disconnection reply (fin ack) and the abnormal disconnection request (reset) can be transmitted to the mobile device as the TCP/IP

protocol process in step S111.

If the received packet is not a connection opening (connecting) packet in step S32 shown in FIG. 17, it is determined in step S47 whether or not a received packet is a data packet on the way from the connection to the disconnection. In this case, after the address information about the destination and the source of the packet is retrieved from the address information storage table 85 using a unique source port number as a key in step S48, the processes in steps S34 and S35 are performed as on a connecting packet.

If it is determined in step S36 that it is not a connecting packet, and if it is determined in step S49 that it is a data packet on the way, the destination address information is retrieved in step S50 as in the process in step S37 on the connecting packet, a TCP connection is identified according to the destination address information, and the TCP/IP protocol handler unit 73 is requested to perform the data transmitting process in step S51 shown in FIG. 18.

The processes in steps S39 to S41 are performed as in the process performed on the connecting packet, it is determined in step S42 that it is not a connecting packet, it is determined in step S52 that it is a data packet on the way, the actual address of the server at which the data packet is to be transmitted from the distribution information table 90 is retrieved using the unique source port number as a key in step S53 shown in FIG. 19, it is determined in step S45 that it is not the case of transmitting a packet of a disconnection reply or an abnormal disconnection request, and the packet is transmitted in step S46, thereby terminating the process.

If it is determined in step S47 shown in FIG. 17 that the received packet is not a data packet on the way, the received packet refers to an abnormal disconnection request

(reset) for a TCP connection or a disconnection reply (fin ask) corresponding to a normal disconnection request, the address information about the destination and the source of the packet is retrieved in step S54 as in step S48, and the processes in steps S34 to S36 are performed, it is determined that the packet is not a data packet on the way in step S49, but it is determined that a disconnection of a TCP connection is performed, the destination address information is retrieved from the address information storage table 85 in step S55, the TCP/IP protocol handler unit 73 is requested to perform the TCP disconnection process on the mobile device side in step S56 shown in FIG. 18, the TCP connection on the server side is identified based on the retrieved destination address in step S55, and the TCP/IP protocol handler unit 73 is requested to perform the disconnecting process.

Then, if after the processes in steps S39 to S42, it is determined in step S52 that it is not a data packet on the way, and if it is determined in step S45 shown in FIG. 19 that a packet of a disconnection reply or an abnormal disconnection request is to be transmitted to a server, and after the deletion of the corresponding record in the address information storage table 85 by the address conversion unit 72 in step S57, then a packet of a disconnection reply or an abnormal disconnection request is transmitted to a service providing server in step S46, thereby terminating the process.

Since the user authentication device 24 assigns an IP address to the mobile device as described above, and a session before a user log-out is performed can normally include a plurality of TCP connections, a TCP connection opening (connecting) packet is not always the first packet in the session, or a TCP normal disconnection (reply) packet or a TCP reset (abnormal disconnection request) packet is not always the last packet in the session.

When the destination address is not a representative address in step S41 shown in FIG. 18, control is directly passed to step S45 shown in FIG. 19. If the packet is a connecting packet or a data packet on the way, then the packet is transmitted to the destination service providing server in step S46, thereby terminating the process. If the packet refers to a disconnection reply or an abnormal disconnection request, then the processes in steps S57 and S46 are performed, thereby terminating the process.

In the case in which the destination address is not a representative address in step S41, a packet is transmitted with the actual address of a service providing server specified in advance instead of transmitting a packet with the representative address of a plurality of service providing servers for providing the same services transmitted from the mobile device. In this case, no representative address can be detected in the balancing policy information table 84, and the packet gateway device does not perform load balancing.

FIGS. 20 and 21 show flowcharts of the distributing process by the packet gateway device of the down packet, that is, a packet transmitted from the service providing server to the mobile device. When the process is started as shown in FIGS. 20 and 21, the packet transmitted from the service providing server in step S101 is received by the address conversion unit 72, the balancing policy information table 84 is referred to in step S102, it is determined in step S103 whether or not the corresponding record including the actual address of the service providing server as the source of the packet has been found. If it has been found, then the source address is converted in step S104 from the actual address of the service providing server to a representative address for a plurality of servers for providing the same services, and it is determined in step S105 whether or not the packet is

an abnormal disconnection request (reset) packet of the TCP connection.

When normal communications are performed in a TCP connection, it is determined that the packet is not a reset packet, the packet is transmitted to the gateway control unit 75 through the TCP/IP protocol handler unit 73 in step S106, and the TCP/IP protocol process is performed in step S107.

In step S108 shown in FIG. 21, the gateway control unit 75 reads the stored address of the mobile device, that is, the source IP address from the address information storage table 85 using the TCP port number as the destination address information about a packet as a key, and it is determined in step S109 whether or not the packet is a data packet of the TCP connection that is on the way.

When it is a data packet on the way, the gateway control unit 75 specifies a socket in step S110 based on the read source (to be a destination) IP address and the port number used as a key, and a data transmission is performed, that is, a send function is issued, through the TCP/IP protocol handler unit 73.

The TCP/IP protocol process is performed in step S111. In step S112, the address conversion unit 72 sets in a packet from the address information storage table 85, using the destination port number as a key, the stored representative address of the service providing server, that is, the stored destination IP address, and the port number, the port number of the mobile device, that is, the stored port number. In step S113, it is determined whether or not a disconnection reply or an abnormal disconnection request is transmitted. If not, the address conversion unit 72 transmits the packet to the mobile device in step S114, thereby terminating the process. The processes in steps S113 and S117 are performed so that the TCP/IP protocol handler unit can transmit the TCP connection

disconnection reply (fin ack) and abnormal disconnection request (reset) to the mobile device as the TCP/IP protocol process for disconnection of a TCP connection in step S35.

If there are no source address of the received packet, that is, the record indicating the representative address corresponding to the actual address of the service providing server, in the balancing policy information table 84 in step S103, that is, if no representative address has been specified as the destination address of an up packet from the mobile device, then the processes in steps S105 to S114 are performed without the process in step S104 performed, and the packet is transmitted to the mobile device. In step S112, the representative address of the service providing server is not set, and the packet is transmitted in step S114.

If the received packet is an abnormal disconnection request of the TCP connection, that is, a reset packet, from the server in step S105 shown in FIG. 20, then the address conversion unit 72 deletes the corresponding record in the distribution information table 90 in step S115, and the processes in steps S106 to S108 are performed.

It is determined in step S109 that the packet is not a data packet. In step S116, the gateway control unit 75 specifies a socket based on the destination IP address and a port number as a key read in step S108, the TCP connection between the server and the mobile device is disconnected, that is, a close function is issued through the TCP/IP protocol handler unit 73.

After the processes in steps S111 and S112, it is determined in step S113 that a disconnection packet is transmitted. In step S117, the address conversion unit 72 deletes the corresponding record in the address information storage table 85. Then, in step S114, the packet is transmitted, thereby terminating the process.

The TCP/IP protocol handler unit 73 of the packet

gateway device stores the source MAC address of the packet, that is, the MAC address of the load balancer as a packet source, in the cache table not shown in the attached drawings corresponding to the IP address of the received packet when an up packet is received. When a down packet is received, the table is searched to set the MAC address of the load balancer which has transmitted an up packet as a destination MAC address, and the down packet is transmitted to the load balancer.

The above-mentioned address conversion in the packet gateway device is further explained below by referring to FIG. 24. In FIG. 24, the source address as the address information about a TCP/IP packet is input in the format of "source network unit. host unit", and the destination address is input in the format of "destination network unit. host unit".

In response to the up packet

Net A. GrA. 1 → Net E. 1

transmitted from the mobile device to the representative address Net E. 1 of the service providing server, the packet gateway device converts the source address into the actual address Net E. 5 of the packet gateway device, and the destination address into the actual address Net E. 7 of the service providing server as

Net E. 5 → Net. E. 7,

and then transmits the conversion result.

The service providing server which has received the up packet transmits a down packet as

Net E. 7 → Net E. 5

to the gateway device, and the packet gateway device inversely converts the stored address of the mobile device into a destination address, and the source address into the representative address of the service providing server, and transmits the down packet to the mobile device.

Described below is the service authentication by the

packet gateway device. It is determined whether or not a service requested by a mobile device, that is, a service provided by a corresponding service providing server, is available by a user of the mobile device.

As described above, in the conventional mobile device packet network described by referring to FIG. 33, a TCP connection is managed by a service providing server itself. Therefore, for example, a TCP connection is to be reconnected each time an available service from the viewpoint of the mobile device is switched. As a result, time delay due to the switching of services including service authentication has been a problem.

FIG. 25 is a flowchart of the service authenticating process by the packet gateway device. This process is basically performed by the service authentication unit 80 shown in FIG. 16. FIG. 26 shows an example of the data stored in the service order information table 87. FIG. 27 shows an example of the data stored in the service providing server information table 88.

When the process is started as shown in FIG. 25, first in step S61, the first service request (connection start) packet transmitted from the mobile device is provided from the gateway control unit 75 for the service authentication unit 80, and a source IP address is retrieved from the packet in step S62.

The source IP address corresponds to the distributed IP address in the session information table 86 shown in FIG. 10, and the corresponding mobile device identification information is retrieved from the table in step S63.

In step S64, a destination IP address is retrieved from the received packet. The destination IP address is a representative IP address of the group of the service providing servers for providing the same services, and the service type corresponding to the representative IP address is determined by referring to FIG. 27.

The service order information table shown in FIG. 26 stores the information about whether or not various services such as mail, chats, etc. corresponding to mobile device identification information are available (OK). In step S65, the contents of FIG. 26 are retrieved according to the mobile device identification information and the service type determined in step S64. In step S66, it is determined whether or not the corresponding service is available.

If it is available, then the received packet is transmitted to the gateway control unit 75 in step S67, and the process of transmitting the packet to the service providing server is continued afterwards. If the service is not permitted in step S66, then the proxy reply unit 81 transmits a TCP reset packet to the mobile device, thereby disconnecting the connection and terminating the process.

FIG. 28 is a flowchart of the accounting information generating process performed by the packet gateway device. FIG. 28 is explained by referring to an example of the data of the accounting record shown in FIG. 29.

In the conventional system shown in FIG. 33, only the service providing server can perform an authenticating process in a contract service unit, and an accounting record for collection of a fee for pay contents is generated in a service providing server unit. Therefore, they cannot be collectively handled in a proxy accounting process, or a proxy accounting for a service fee cannot be performed by an externally connected server of the system.

According to the present embodiment, the packet information collection unit 78 shown in FIG. 16 collects the number of packets and the total packet length for each combination of address information about a mobile device and address information about a service providing server for generation of an accounting log, and notifies the accounting log edition unit 82 of the result. When there

is accounting attribute information to be interpolated for designation of an accounting target, the accounting attribute notification unit 79 manages the information obtained from the data packets of the users, and the result is transmitted to the accounting log edition unit 82.

The accounting log edition unit 82 edits the accounting log according to the information obtained from the packet information collection unit 78 and the accounting attribute notification unit 79, and the result is stored in the accounting log DB 89. The contents of the accounting log include a source which can be determined from the session information according to the address information about the mobile device, a destination as an IP address of the service providing server according to the notification from the packet information collection unit 78, and the accounting attribute information obtained from the accounting attribute notification unit 79.

When the process is started as shown in FIG. 28, first in step S70, a received packet is received by the packet information collection unit 78 through the address conversion unit 72. In step S71, it is determined whether or not the packet is a TCP connection opening packet, that is, a TCP syn packet.

If it is an opening packet, a new accounting record is generated in step S72, a destination IP address, a destination IP address is retrieved from a received packet by the packet information collection unit 78, and is set in the accounting record, and then control is passed to step S73. If it is not an opening packet, control is passed directly to step S73.

In step S73, it is determined whether or not a received packet contains accounting attribute information, for example, the URL, etc. of the connection server when an external connection is made as shown in FIG. 29. If yes, the accounting attribute information is set in the

accounting record in step S74, and control is passed to step S75. If not, control is passed directly to step S75.

In step S75, the number of packets of the accounting records is incremented by 1. In step S76, the packet length retrieved from the received packet is added to the total packet length of the accounting records. In step S77, it is determined whether or not the TCP connection is to be disconnected, that is, the received packet is a TCP fin ack packet. If not, the processes in and after step S70 are repeated.

If the TCP connection is to be disconnected, the packet information collection unit 78 transmits an accounting record to the accounting log edition unit 82 in step S78. In step S79, the accounting log edition unit 82 edits the accounting record, that is, the mobile device identification information is set from the source IP address, and the service type and the representative IP address of the service providing server are set from the destination address. In step S80, the result is written as an accounting log to the accounting log DB 89, thereby terminating the process. FIG. 29 shows the storage result in the accounting log DB 89, and the collected contents in the packet information collection unit 78, for example, the destination IP addresses, are converted into mobile device identification information and stored as an accounting log.

FIG. 30 shows the inter-device process sequence when a session terminates. FIG. 30 corresponds to the inter-device process sequence when a session starts as shown in FIG. 3, and shows the sequence when a user log-out occurs to terminate the communications by the mobile device 20.

When the user log-out occurs as shown in FIG. 30, the network access device 22 transmits an account stop to the user authentication device 24, the user authentication device 24 receives it and transmits a status change (close) to the session management device 27, and transmits a

session termination notification packet to the packet gateway device 28. The packet format of these packets is shown in FIG. 6.

The session management unit 54 of the session management device deletes a corresponding record in the session information table 55, and the session management unit 83 of the packet gateway device also deletes a corresponding record in the session information table 86.

FIG. 31 shows the sequence of the processes performed in a dormant state, that is, when a TCP connection continues but no communications are performed with a mobile device for a predetermined period. Normally, the network access device 22 transmits an account start to the user authentication device 24 when a TCP connection starts, and simultaneously starts the monitor by the dormant timer. A session information entry from the user authentication device 24 to the session management device 27 and a session start notification to the packet gateway device 28 are similarly transmitted as shown in FIG. 3.

However, if a timeout of the dormant timer occurs before a data packet from the user is transmitted from the mobile device 20 to the network access device 22, then the network access device 22 transmits an account stop to the user authentication device 24.

Upon receipt of the account stop, the user authentication device 24 transmits a status change (stop) to the session management device 27, and the session management unit 54 of the session management device changes the session state of the corresponding record in the session information table 55 into "dormant". The session management unit 83 of the packet gateway device 28 also changes the session state of the corresponding record in the session information table 86 into "dormant".

The network access device 22 starts monitoring the session timer after the timeout of the dormant timer occurs.

If the timeout of the session timer occurs although not shown in FIG. 31, then an account stop is transmitted to the user authentication device 24.

Upon receipt of the account stop, the user authentication device 24 transmits a status change (close) to the session management device 27, and transmits a session termination notification to the packet gateway device 28.

The session management unit 54 of the session management device and the session management unit 83 of the packet gateway device change the session state of a corresponding record in the session information table into close.

On the other hand, when a user data packet is received again from the mobile device 20 as shown in FIG. 31 before a timeout of the session timer occurs, the network access device 22 transmits the account start again to the user authentication device 24, and transmits the data packet to the path of the load balancer.

When the user authentication device 24 receives the account start, it transmits a status change (start) to the session management device 27.

The session management unit 54 of the session management device and the session management unit 83 of the packet gateway device change the session state of a corresponding record in the session information table into "act". The transmission/reception of the data packet after the load balancer 25 is performed as in the session starting process as shown in FIG. 3.

Described below is the process performed when the packet gateway device for performing the most important function according to the present embodiment is down. The server monitor unit 45 of the user authentication device makes a health check for collecting operating states of the packet gateway device 28 at predetermined intervals as

described above. When the packet gateway device is down, the load balancer 25 and the session management device 27 is notified of the information.

The existing session between the packet gateway device 28 and the service providing server 30 is disconnected, and the down packet of the existing session is discarded by the packet gateway device 28 or the service providing server 30.

The user management unit 44 of the user authentication device 24 assigns the address information, outside of the range assigned to the down packet gateway device, to a new session based on the address information table such that the new session cannot be distributed to the down packet gateway device.

When the packet gateway devices 28 are down in multiple, a packet is distributed to a packet gateway device as a proxy device for distribution.

When the packet gateway device 28 is restored, the server monitor unit 45 of the user authentication device notifies the load balancer 25 and the session management device 27 of the information. The user management unit 44 of the user authentication device 24 resumes assigning the address information to the restored packet gateway device 28, and the load balancer 25 resumes distributing a packet to the restored packet gateway device 28.

Finally, the process of loading a program according to the present embodiment to a computer is described below. The packet gateway device 28, the session management device 27, the user authentication device 24, and the load balancer 25 having important functions in the present embodiment comprise computers as important components. FIG. 32 is a common block diagram of a computer system.

In FIG. 32, a computer 91 is configured by a body 92 and memory 93. The memory 93 can be storage devices of various forms such as random access memory (RAM), a hard

disk, a magnetic disk, etc. The memory 93 stores the programs shown in the flowcharts in FIGS. 5, 13, 17 through 21, 25, and 28 and the programs according to claims 9 through 14 of the present invention. By the execution by the body 92, the connection in the session can be maintained, the gateway function including the central management of sessions, etc. can be realized.

Thus, the program can be loaded from a program provider to the computer 91 through a network 94, or can be stored in a portable storage medium 95 marketed and distributed, and can be loaded to the computer 91. The handy storage medium 95 can be any storage media in various forms such as CD-ROM, a flexible disk, an optical disk, a magneto-optic disk, etc. These storage media can be set in the computer 91 to maintain a session, and realize a gateway function, etc.

In the above-mentioned explanation, the embodiment of the present invention is explained using a mobile device packet network to which a mobile phone as a mobile device is connected, but the target of the present invention is not limited to a mobile device packet network, and any communications system having a communications terminal connected thereto and using a network having a plurality of input/output points of a plurality of service providing servers can be applied to the communications systems of various types.

As described above in detail, although the network access devices are switched and the load balancer are dynamically switched by the movement of a mobile device for passing packets according to the present invention, the packet gateway device can distribute the packets to the same service providing server, a session can be controlled, and effective load balancing can be performed. Additionally, the network access device can be extended/changed without changing the definitions on the

mobile device packet network side.

Furthermore, since the same packet gateway device passes not only an up packet to be transmitted to a service providing server and a down packet to be transmitted to a mobile device, but also the subsequent up packet, the following five gateway functions can be realized on the same path.

The first function is the central managing capability of a session. Although the central management can be performed by the packet gateway device on a session and services are switched from the viewpoint of the mobile device, sessions are not to be reconnected among service providing servers, thereby requiring no time to switch services.

The second function is the risk balancing capability when a service providing server goes down. Since the packet gateway device can continue a session by switching into a substitute server for providing the same services, the risk of failing in continuing a service can be avoided.

The third function is the proxy accounting capability. Since the packet gateway device can centrally manage sessions, the authentication can be performed in a contract service unit by referring to the authentication contract information about a user of a service, and the accounting information about the fee for pay contents can be generated by proxy.

The fourth function is the protocol conversion capability of a transport layer between a wireless network and a cable network. Since an Internet standard service is used in the wireless communications, the protocol conversion of the transport layer between the wireless network and the cable network such as a window size, etc. can be realized by the packet gateway device.

The fifth function is the gateway function between an IP version 4 network and an IP version 6 network. When an

Internet protocol version 6 is implemented, the gateway function using the current version 4 network can be realized.

Industrial Applicability

The present invention is applicable for wireless and cable communications systems. Especially, it is effectively used in a communications system which uses a large-scale network having a plurality of input/output points on a service providing server, and is managed by a common carrier for providing communications services.

Claims

1. A mobile device communications system which has a plurality of service providing servers, and is used for communications by a mobile terminal, comprising:

first network means which is connected to the mobile terminal and has a plurality of input/output points to and from the service providing servers;

a plurality of first communications distribution means respectively connected to the plurality of input/output points;

second network means connected to said first communications distribution means;

third network means connected to the plurality of service providing servers; and

a plurality of second communications distribution means which are connected between said second network means and said third network means, for distributing a series of communications between the mobile terminal and the service providing server to any of the plurality of service providing server, characterized in that

said first communications distribution means distributes a series of communications between said mobile terminal and service providing servers to any of said plurality of second communications distribution means through said second network means.

2. The system according to claim 1, further comprising

session management means for assigning an identifier to a session as a series of communications between the mobile terminal and the service providing servers to manage the identifier.

3. The system according to claim 1, characterized in that

each of said plurality of first communications distribution means comprises same storage contents of

distribution destination storage means for storing any of said plurality of second communications distribution means to which a series of communications are to be distributed corresponding to an identifier of a session as the series of communications between the mobile terminal and the service providing servers.

4. The system according to claim 1, characterized in that:

the plurality of service providing servers form a plurality of groups each being configured by servers providing same services;

the mobile terminal specifies a representative address for each of the plurality of groups to communicate with service providing servers; and

said second communications distribution means distributes the series of communications to any of the service providing servers in a group specified by the representative address.

5. The system according to claim 4, characterized in that

when the mobile terminal changes the representative address for a change of a service to be obtained in the series of communications, said second communications distribution means distributes subsequent communications in the series of communications to any of the service providing servers in the group specified by the representative address after the change to continue the series of communications.

6. The system according to claim 1, further comprising

server authentication means for checking whether or not a user of the mobile terminal has a right to receive a service provided by the service providing servers when said second communications distribution means distributes the series of communications to any of the plurality of service providing servers.

7. The system according to claim 1, characterized in that:

said second communications distribution means can distribute the series of communications not only to the plurality of service providing servers, but also to a server external to said mobile device communications system; and

said system further comprises accounting information generation means for generating accounting information about a service received by the mobile terminal from the service providing servers or a server external to said mobile device communications system.

8. A mobile device communications method for use with a plurality of service providing servers for communications by a mobile terminal, comprising the steps of:

the mobile terminal transmitting a packet in a series of communications by specifying any of the plurality of service providing servers;

a load balancer, which received the packet, distributing the packet to any of the plurality of packet gateway devices corresponding to an identifier for the series of communications; and

said packet gateway device which was assigned the packet distributing the packet to any of the plurality of service providing servers for performing the same services as the service providing server specified by the mobile terminal.

9. A computer-readable portable storage medium which is used by a computer configuring a packet gateway device for distributing communications to a service providing server between a plurality of load balancers and service providing servers connected to a network to which a mobile terminal is connected in a mobile device communications system having the plurality of service providing servers for establishment of communications performed by the mobile

terminal, and stores a program used to direct the computer to perform the steps of:

storing a destination address and a source address of a packet received from the load balancer using a unique source port number as a key;

setting the unique source port number as a source port number of a packet header;

selecting any of a plurality of service providing servers capable of providing a service requested by the mobile terminal from among the plurality of service providing servers such that the loads of the service providing servers can be balanced; and

transmitting a packet to the service providing server with an address of the selected service providing server set as a destination address, and an address of the device set as a source address.

10. A program used by a computer configuring a packet gateway device for distributing communications to a service providing server between a plurality of load balancers and service providing servers connected to a network to which a mobile terminal is connected in a mobile device communications system having the plurality of service providing servers for establishment of communications performed by the mobile terminal, and is used to direct the computer to perform the procedures of:

storing a destination address and a source address of a packet received from the load balancer using a unique source port number as a key;

setting the unique source port number as a source port number of a packet header;

selecting any of a plurality of service providing servers capable of providing a service requested by the mobile terminal from among the plurality of service providing servers such that the loads of the service providing servers can be balanced; and

transmitting a packet to the service providing server with an address of the selected service providing server set as a destination address, and an address of the device set as a source address.

11. A computer-readable portable storage medium which is used by a computer configuring a packet gateway device for distributing communications to a service providing server between a plurality of load balancers and service providing servers connected to a network to which a mobile terminal is connected in a mobile device communications system having the plurality of service providing servers for establishment of communications performed by the mobile terminal, and stores a program used to direct the computer to perform the steps of:

retrieving mobile device identification information about a mobile terminal as a source of a packet received from the load balancer;

retrieving a destination address of the received packet;

determining whether or not a service provided by the service providing server of the destination address can be provided for a user of the mobile terminal based on the mobile device identification information and the destination address.

12. A computer-readable portable storage medium which is used by a computer configuring a packet gateway device for distributing communications to a service providing server between a plurality of load balancers and service providing servers connected to a network to which a mobile terminal is connected in a mobile device communications system having the plurality of service providing servers for establishment of communications performed by the mobile terminal, and stores a program used to direct the computer to perform the steps of:

retrieving from a packet received from the load

balancer a destination address and a source address of the packet when a series of communications between the mobile terminal and the service providing server start, and setting the addresses in an accounting record;

incrementing the number of packets of an accounting record each time a packet is received from the load balancer until the series of communications terminate, retrieving a packet length from the received packet, and adding the packet length to the packet length of the accounting record; and

setting again the source address of the accounting record into identification information about a user of the mobile terminal, and the destination address into information about the service providing server when the series of communications terminate.

13. A program used by a computer configuring a packet gateway device for distributing communications to a service providing server between a plurality of load balancers and service providing servers connected to a network to which a mobile terminal is connected in a mobile device communications system having the plurality of service providing servers for establishment of communications performed by the mobile terminal, and is used to direct the computer to perform the procedures of:

retrieving mobile device identification information about a mobile terminal as a source of a packet received from the load balancer;

retrieving a destination address of the received packet;

determining whether or not a service provided by the service providing server of the destination address can be provided for a user of the mobile terminal based on the mobile device identification information and the destination address.

14. A program used by a computer configuring a packet

gateway device for distributing communications to a service providing server between a plurality of load balancers and service providing servers connected to a network to which a mobile terminal is connected in a mobile device communications system having the plurality of service providing servers for establishment of communications performed by the mobile terminal, and is used to direct the computer to perform the procedures of:

retrieving from a packet received from the load balancer a destination address and a source address of the packet when a series of communications between the mobile terminal and the service providing server start, and setting the addresses in an accounting record;

incrementing the number of packets of an accounting record each time a packet is received from the load balancer until the series of communications terminate, retrieving a packet length from the received packet, and adding the packet length to the packet length of the accounting record; and

setting again the source address of the accounting record into identification information about a user of the mobile terminal, and the destination address into information about the service providing server when the series of communications terminate.

15. A mobile device communications system which has a plurality of service providing servers, and is used for communications by a mobile terminal, comprising:

network means which is connected to the mobile terminal and has a plurality of input/output points to and from the service providing servers;

a plurality of first communications distribution means respectively connected to the plurality of input/output points; and

a plurality of second communications distribution means, connected between said plurality of first

communications distribution means and the plurality of service providing servers, for distributing a series of communications between the mobile terminal and the service providing server to any of the plurality of service providing servers, characterized in that

even if the plurality of first communications distribution means enter different input points, any of said plurality of first communications distribution means is distributed to any of said plurality of second communications distribution means from start to termination of the series of communications between the mobile terminal and the service providing server.

Abstract

In a communications system connected to a mobile terminal and using a network having a plurality of input/output points at a plurality of service providing servers, a series of communication packets are always passed taking the same route.

Load balancers connected to the plurality of input/output points distribute a series of communication packets always in the same packet gateway among a plurality of packet gateways arranged between the load balancers and the service providing servers, and the packet gateway to which a packet is distributed distributes the series of communication packets to a plurality of service providing servers capable of executing an identical service.

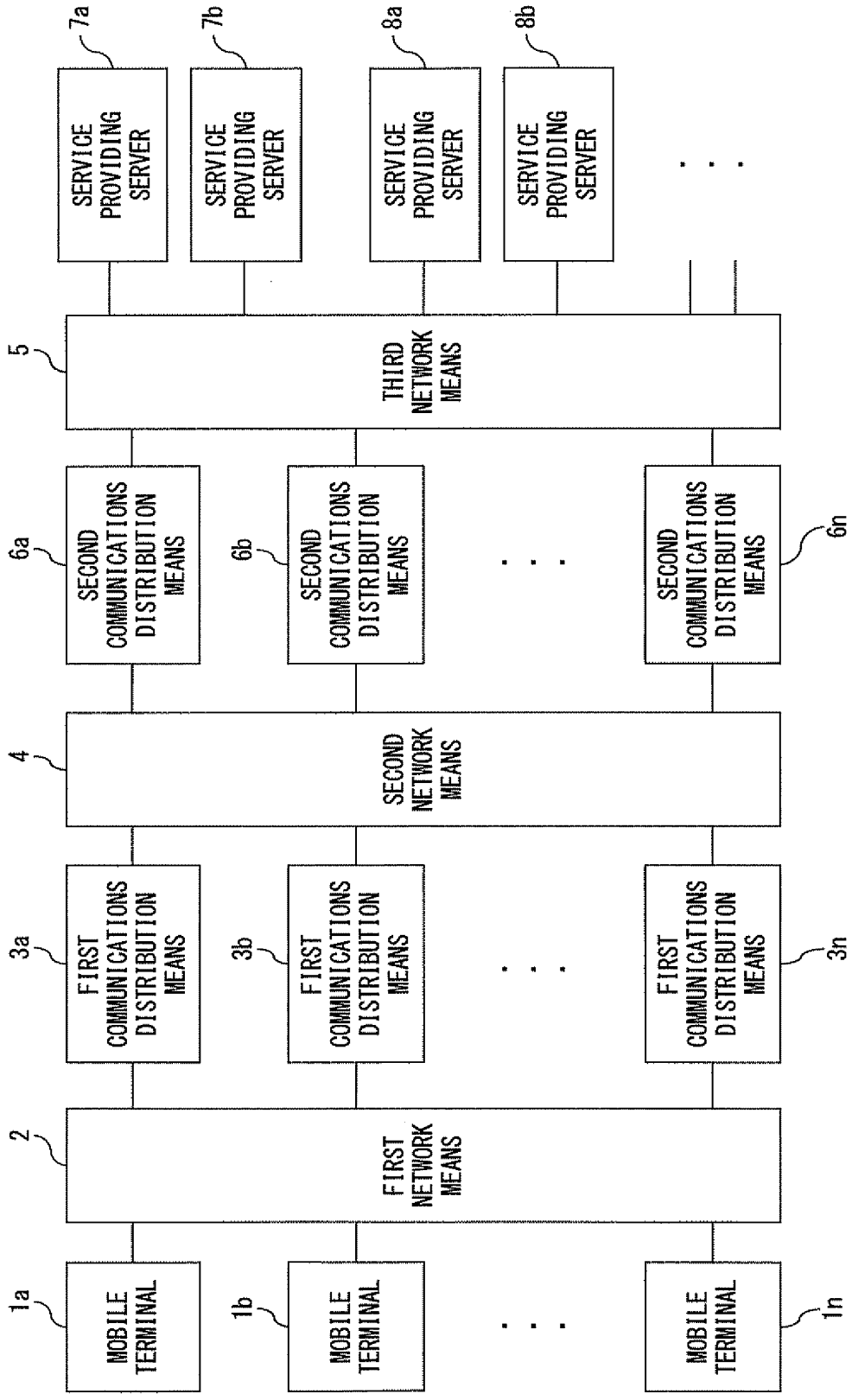

7a
7b
8a
8b
SERVICE PROVIDING SERVER
SERVICE PROVIDING SERVER
SERVICE PROVIDING SERVER
SERVICE PROVIDING SERVER
5
THIRD NETWORK MEANS
6a
6b
6n
SECOND COMMUNICATIONS DISTRIBUTION MEANS
SECOND COMMUNICATIONS DISTRIBUTION MEANS
SECOND COMMUNICATIONS DISTRIBUTION MEANS
4
SECOND NETWORK MEANS
3a
3b
3n
FIRST COMMUNICATIONS DISTRIBUTION MEANS
FIRST COMMUNICATIONS DISTRIBUTION MEANS
FIRST COMMUNICATIONS DISTRIBUTION MEANS
2
FIRST NETWORK MEANS
1a
1b
1n
MOBILE TERMINAL
MOBILE TERMINAL
MOBILE TERMINAL

FIG. 1

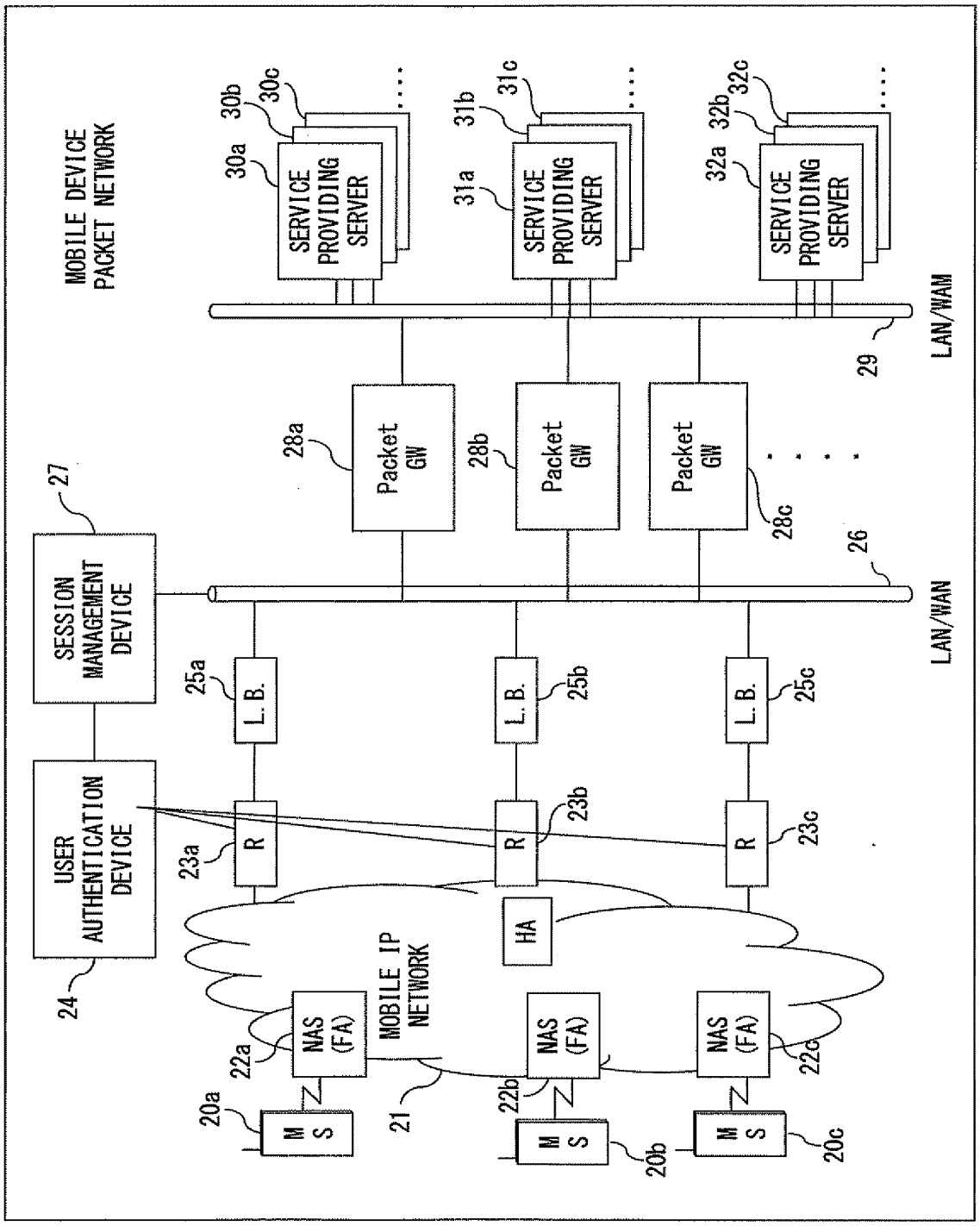

MOBILE DEVICE PACKET NETWORK
SERVICE PROVIDING SERVER
30a
30b
30c
31a
31b
31c
32a
32b
32c
LAN/WAN
29
Packet GW
28a
28b
28c
26
27
SESSION MANAGEMENT DEVICE
L. B.
25a
25b
25c
USER AUTHENTICATION DEVICE
24
R
23a
23b
23c
HA
MOBILE IP NETWORK
21
NAS (FA)
22a
22b
22c
M S
20a
20b
20c

FIG. 2

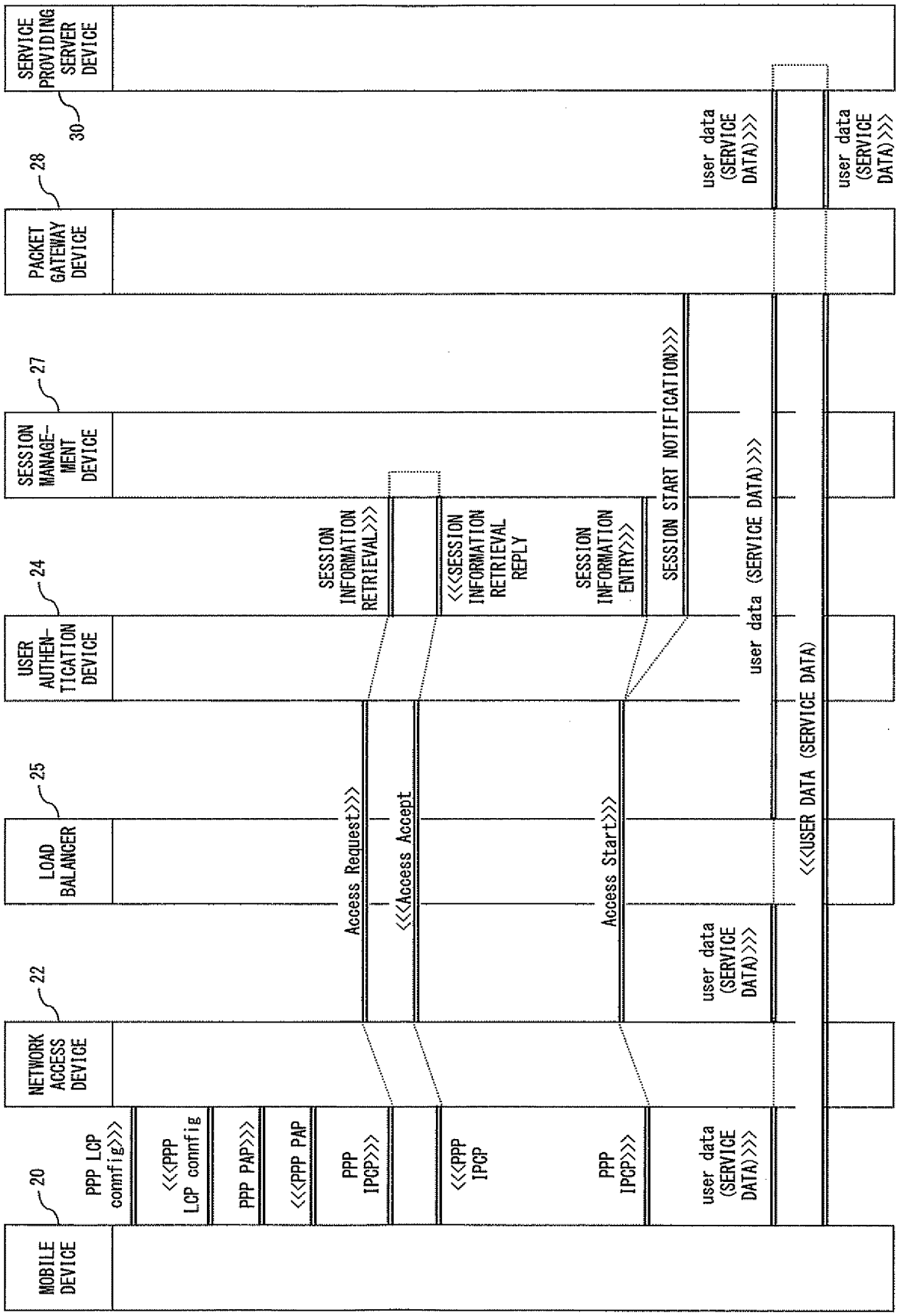

MOBILE DEVICE
20
NETWORK ACCESS DEVICE
22
LOAD BALANCER
25
USER AUTHEN-TICATION DEVICE
24
SESSION MANAGE-MENT DEVICE
27
PACKET GATEWAY DEVICE
28
SERVICE PROVIDING SERVER DEVICE
30
PPP LCP comfig>>>
<<<PPP LCP comfig
PPP PAP>>>
<<<PPP PAP
PPP IPCP>>>
<<<PPP IPCP
PPP IPCP>>>
user data (SERVICE DATA)>>>
Access Request>>>
<<<Access Accept
Access Start>>>
SESSION INFORMATION RETRIEVAL>>>
<<<SESSION INFORMATION RETRIEVAL REPLY
SESSION INFORMATION ENTRY>>>
SESSION START NOTIFICATION>>>
user data (SERVICE DATA)>>>
<<<USER DATA (SERVICE DATA)
user data (SERVICE DATA)>>>
user data (SERVICE DATA)>>>

FIG. 3

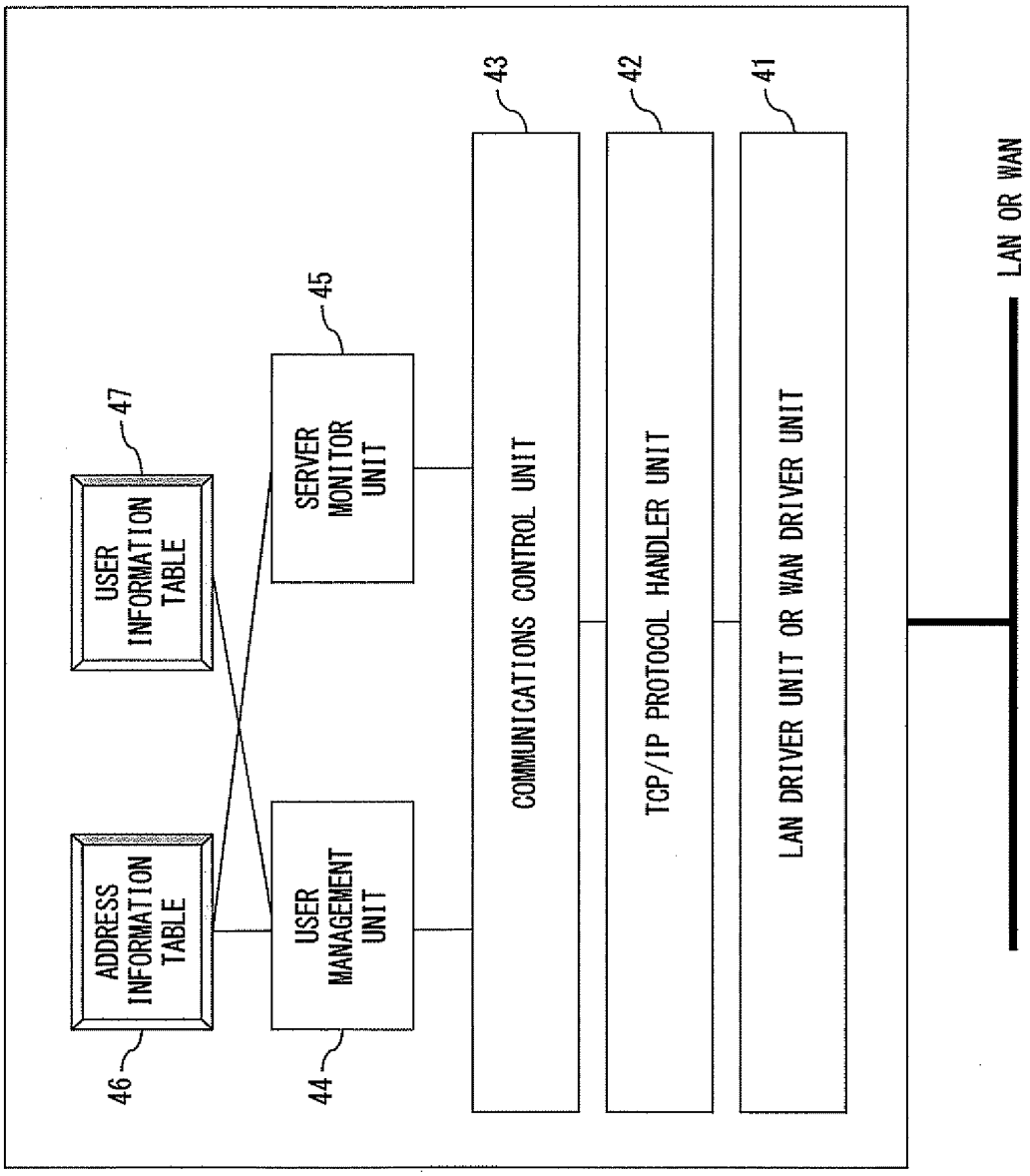

43
42
41
45
47
SERVER MONITOR UNIT
USER INFORMATION TABLE
COMMUNICATIONS CONTROL UNIT
TCP/IP PROTOCOL HANDLER UNIT
LAN DRIVER UNIT OR WAN DRIVER UNIT
LAN OR WAN
ADDRESS INFORMATION TABLE
USER MANAGEMENT UNIT
46
44

FIG. 4

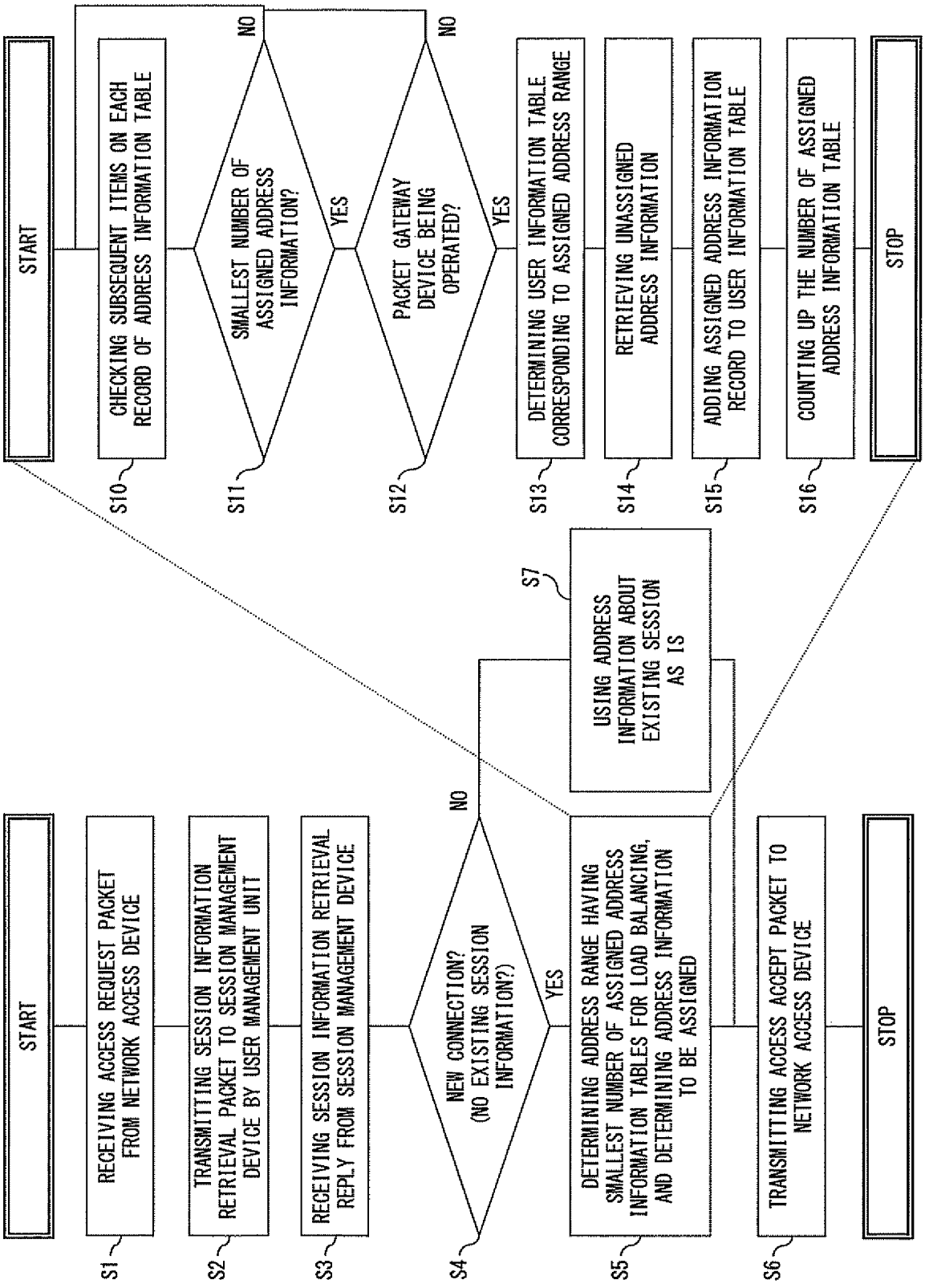

START
RECEIVING ACCESS REQUEST PACKET FROM NETWORK ACCESS DEVICE
S1
TRANSMITTING SESSION INFORMATION RETRIEVAL PACKET TO SESSION MANAGEMENT DEVICE BY USER MANAGEMENT UNIT
S2
RECEIVING SESSION INFORMATION RETRIEVAL REPLY FROM SESSION MANAGEMENT DEVICE
S3
NEW CONNECTION? (NO EXISTING SESSION INFORMATION?)
S4
NO
YES
USING ADDRESS INFORMATION ABOUT EXISTING SESSION AS IS
S7
DETERMINING ADDRESS RANGE HAVING SMALLEST NUMBER OF ASSIGNED ADDRESS INFORMATION TABLES FOR LOAD BALANCING, AND DETERMINING ADDRESS INFORMATION TO BE ASSIGNED
S5
TRANSMITTING ACCESS ACCEPT PACKET TO NETWORK ACCESS DEVICE
S6
STOP
START
CHECKING SUBSEQUENT ITEMS ON EACH RECORD OF ADDRESS INFORMATION TABLE
S10
SMALLEST NUMBER OF ASSIGNED ADDRESS INFORMATION?
S11
NO
YES
PACKET GATEWAY DEVICE BEING OPERATED?
S12
NO
YES
DETERMINING USER INFORMATION TABLE CORRESPONDING TO ASSIGNED ADDRESS RANGE
S13
RETRIEVING UNASSIGNED ADDRESS INFORMATION
S14
ADDING ASSIGNED ADDRESS INFORMATION RECORD TO USER INFORMATION TABLE
S15
COUNTING UP THE NUMBER OF ASSIGNED ADDRESS INFORMATION TABLE
S16
STOP

FIG. 5

SESSION INFORMATION RETRIEVAL

PACKET TYPE

TCP/IP HEADER	SESSION INFORMATION RETRIEVAL	MOBILE DEVICE IDENTIFICATION INFORMATION

STATUS CHANGE

PACKET TYPE Status

TCP/IP HEADER	STATUS CHANGE	Start/Stop/ Close/Interim

SESSION INFORMATION RETRIEVAL REPLAY

PACKET TYPE RETRIEVAL RESULT

TCP/IP HEADER	SESSION INFORMATION RETRIEVAL REPLAY	MOBILE DEVICE IDENTIFICATION INFORMATION	PRESENCE/ ABSENCE	IP ADDRESS

SESSION START NOTIFICATION

PACKET TYPE

TCP/IP HEADER	SESSION START NOTIFICATION	MOBILE DEVICE IDENTIFICATION INFORMATION	IP ADDRESS

SESSION INFORMATION ENTRY

PACKET TYPE

TCP/IP HEADER	SESSION INFORMATION ENTRY	MOBILE DEVICE IDENTIFICATION INFORMATION	IP ADDRESS

SESSION TERMINATION NOTIFICATION

PACKET TYPE

TCP/IP HEADER	SESSION TERMINATION NOTIFICATION	IP ADDRESS

FIG. 6

NAME OF PACKET GATEWAY DEVICE	IP ADDRESS ASSIGNMENT RANGE		NUMBER OF ASSIGNED IP ADDRESSES	OPERATING STATUS OF PACKET GATEWAY DEVICE	USER INFORMATION TABLE ADDRESS
Pgw1	10. 0. 0. 1	10. 32. 0. 0	20	OPERATING	*
Pgw2	10. 32. 0. 1	10. 64. 0. 0	20	OPERATING	*
Pgw3	10. 64. 0. 1	10. 96. 0. 0	20	OPERATING	*
Pgw4	10. 96. 0. 1	10. 128. 0. 0	19	OPERATING	*

FIG. 7

USER IDENTIFICATION INFORMATION				ASSIGNED IP ADDRESS INFORMATION
USER IDENTIFIER	PASSWORD	MOBILE DEVICE IDENTIFICATION INFORMATION	PHONE NUMBER	IP ADDRESS
E0658	E0658aaaa	F50200001	9077771111	10. 32. 0. 1
E0668	E0668aaaa	F50200002	9077771112	10. 32. 0. 2
E0678	E0678aaaa	F50200003	9077771113	10. 32. 0. 3
E0688	E0688aaaa	F50200004	9077771114	10. 32. 0. 4

FIG. 8

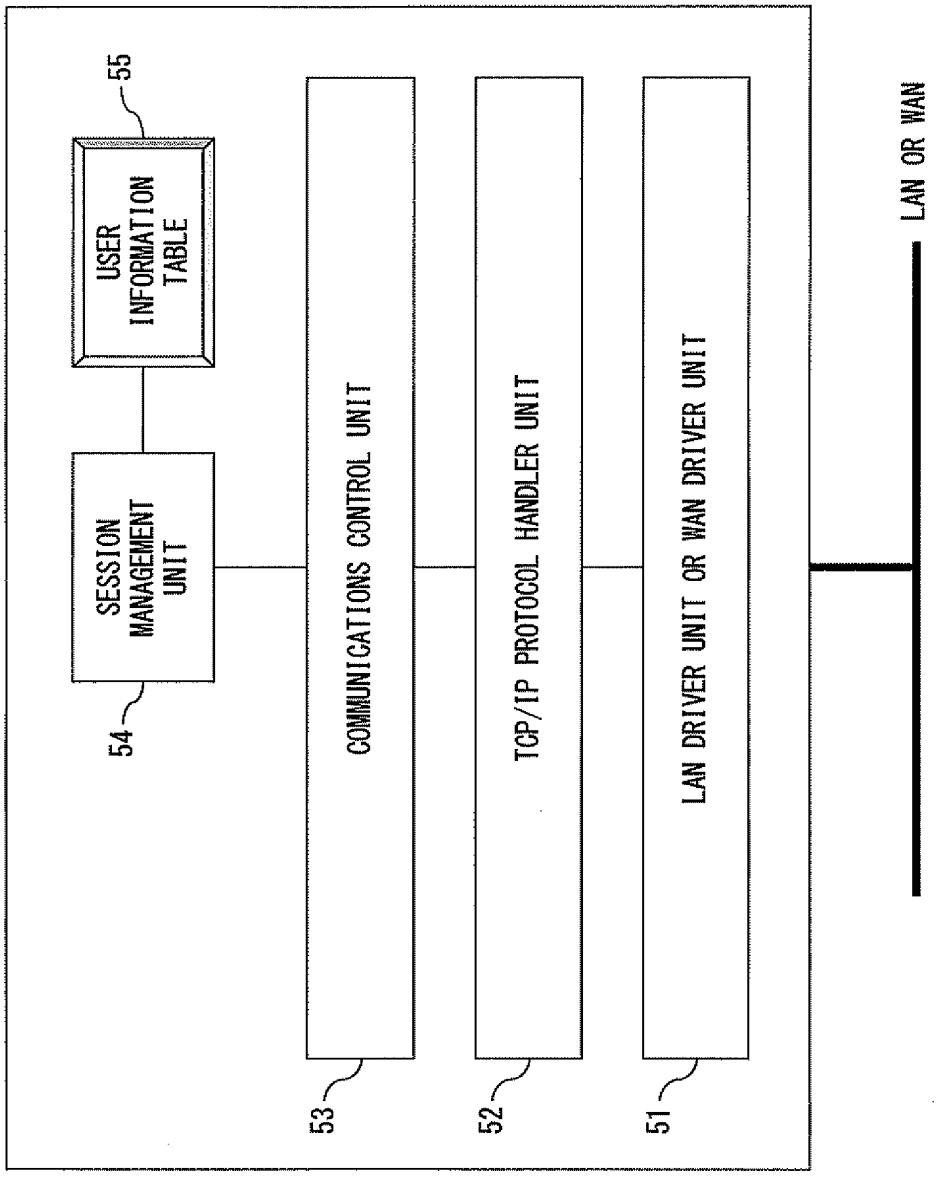
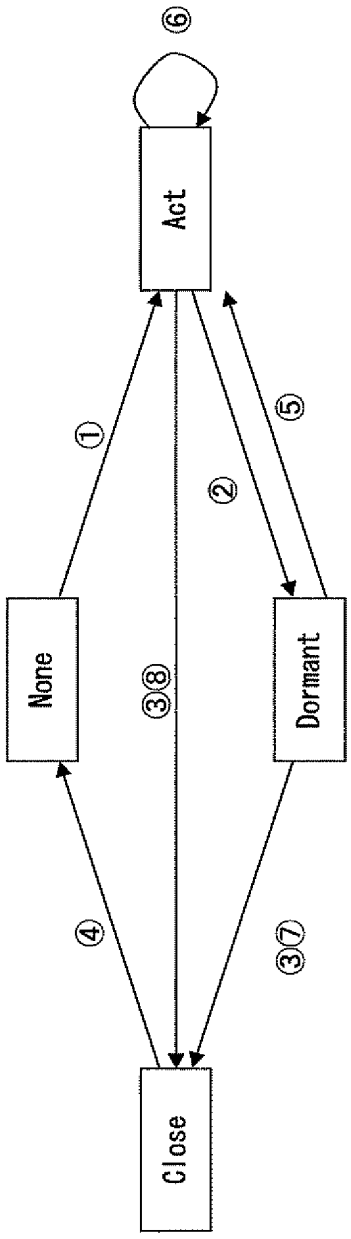

55
USER INFORMATION TABLE
SESSION MANAGEMENT UNIT
54
COMMUNICATIONS CONTROL UNIT
TCP/IP PROTOCOL HANDLER UNIT
LAN DRIVER UNIT OR WAN DRIVER UNIT
53
52
51
LAN OR WAN

FIG. 9

SESSION IDENTIFICATION INFORMATION	MOBILE DEVICE IDENTIFICATION INFORMATION	ASSIGNED IP ADDRESS INFORMATION	SESSION STATE
SESSION IDENTIFIER	MOBILE DEVICE IDENTIFIER	IP ADDRESS	
10010001	F50200001	10. 32. 0. 1	Act
10010002	F50200002	10. 32. 0. 2	Act
10010003	F50200003	10. 32. 0. 3	Act
10010004	F50200004	10. 32. 0. 4	Act

FIG. 10



NUMBER	STATE TRANSITION TRIGGER
①	SESSION INFORMATION ENTRY FROM USER AUTHENTICATION DEVICE
②	STATUS CHANGE (STOP) FROM USER AUTHENTICATION DEVICE
③	STATUS CHANGE (CLOSE) FROM USER AUTHENTICATION DEVICE
④	SESSION LOG OUTPUT
⑤	STATUS CHANGE (START) FROM USER AUTHENTICATION DEVICE
⑥	STATUS CHANGE (INTERIM) FROM USER AUTHENTICATION DEVICE
⑦	SESSION TIMER TIMEOUT
⑧	INTERIM MONITOR TIMER TIMEOUT

FIG. 11

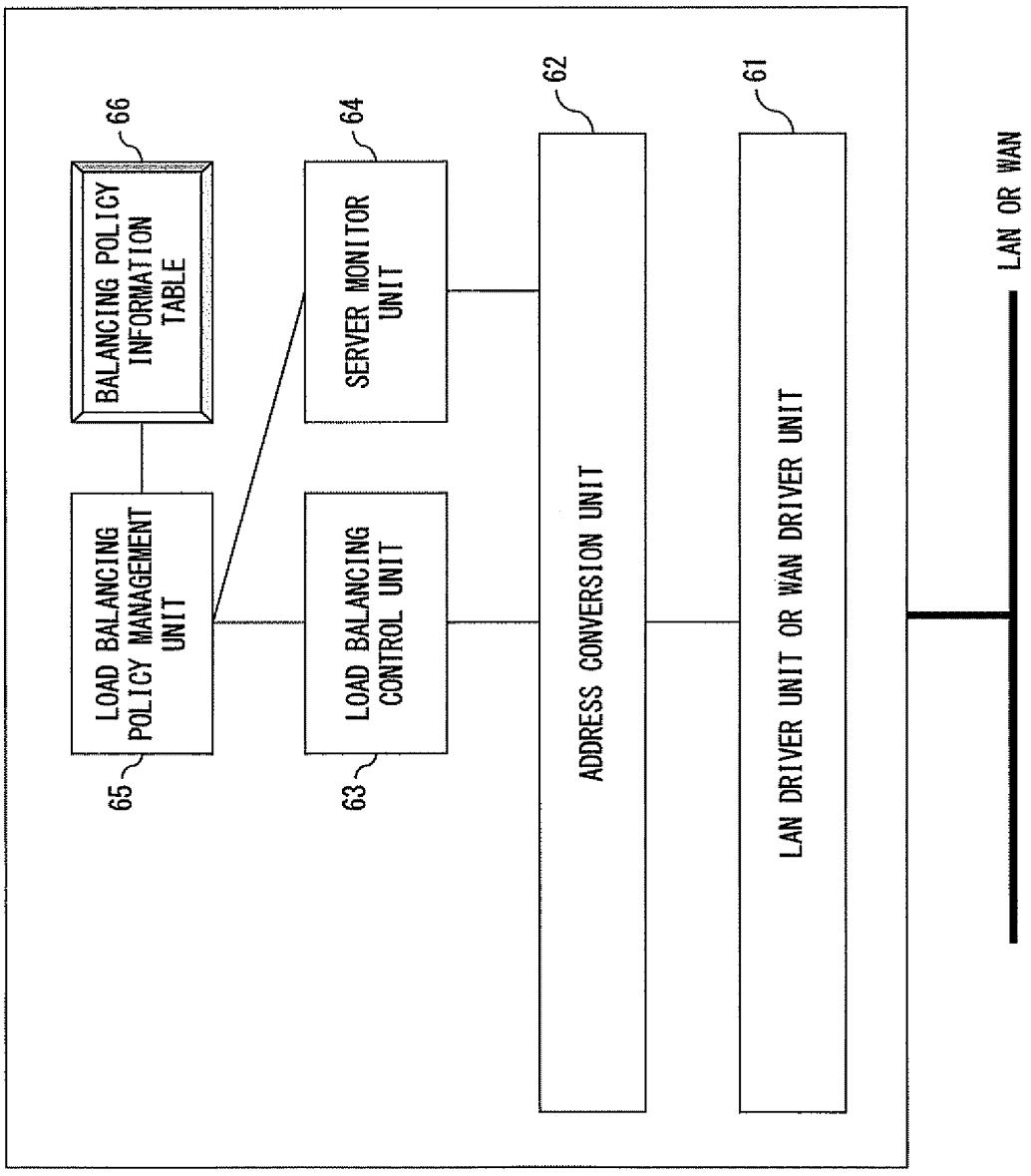

66
BALANCING POLICY INFORMATION TABLE
64
SERVER MONITOR UNIT
62
61
LAN OR WAN
LOAD BALANCING POLICY MANAGEMENT UNIT
LOAD BALANCING CONTROL UNIT
ADDRESS CONVERSION UNIT
LAN DRIVER UNIT OR WAN DRIVER UNIT
65
63

FIG. 12

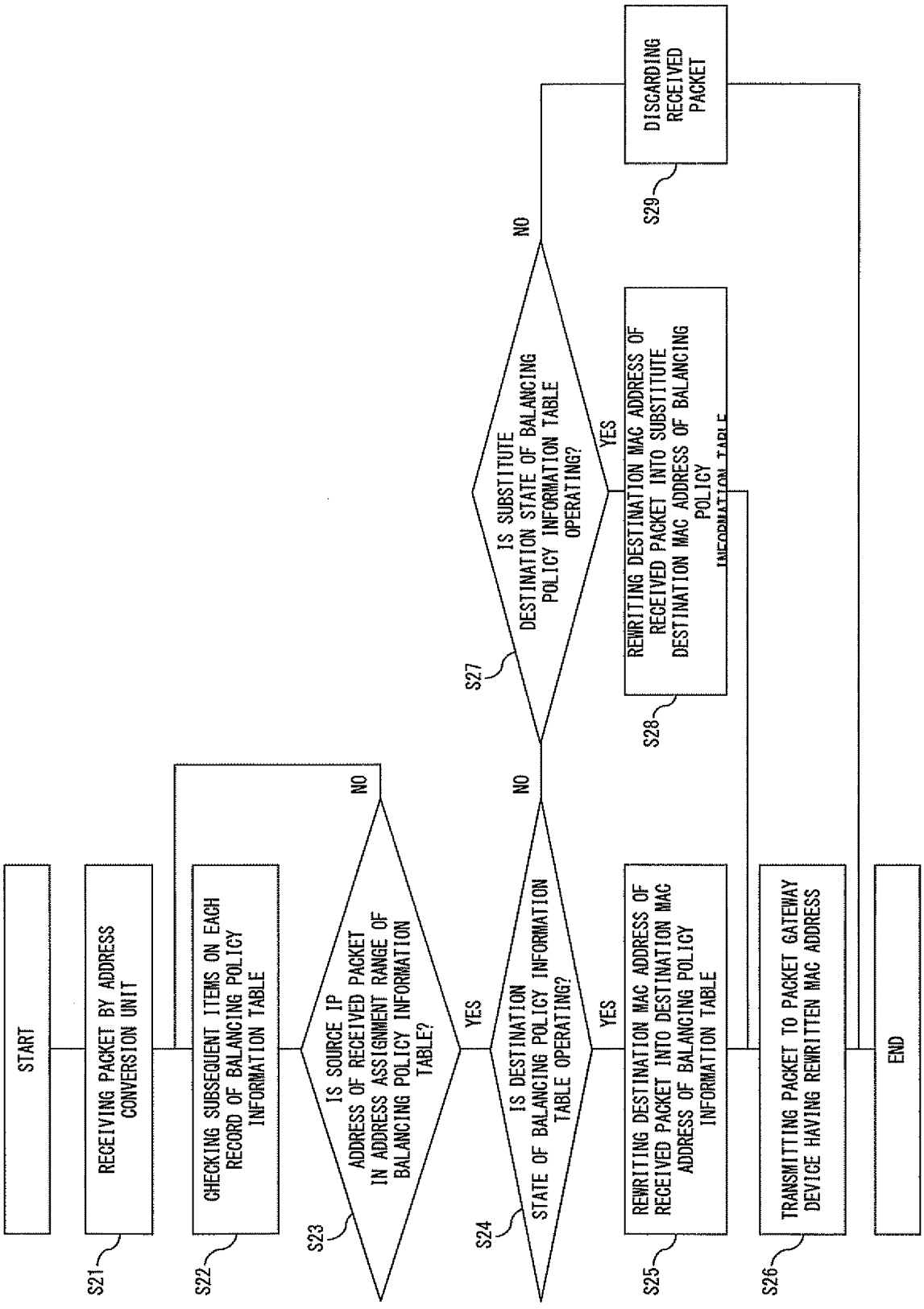

START
RECEIVING PACKET BY ADDRESS CONVERSION UNIT
S21
CHECKING SUBSEQUENT ITEMS ON EACH RECORD OF BALANCING POLICY INFORMATION TABLE
S22
IS SOURCE IP ADDRESS OF RECEIVED PACKET IN ADDRESS ASSIGNMENT RANGE OF BALANCING POLICY INFORMATION TABLE?
S23
NO
YES
IS DESTINATION STATE OF BALANCING POLICY INFORMATION TABLE OPERATING?
S24
NO
YES
IS SUBSTITUTE DESTINATION STATE OF BALANCING POLICY INFORMATION TABLE OPERATING?
S27
NO
YES
DISCARDING RECEIVED PACKET
S29
REWRITING DESTINATION MAC ADDRESS OF RECEIVED PACKET INTO SUBSTITUTE DESTINATION MAC ADDRESS OF BALANCING POLICY
S28
REWRITING DESTINATION MAC ADDRESS OF RECEIVED PACKET INTO DESTINATION MAC ADDRESS OF BALANCING POLICY INFORMATION TABLE
S25
TRANSMITTING PACKET TO PACKET GATEWAY DEVICE HAVING REWRITTEN MAC ADDRESS
S26
END

FIG. 13

IP ADDRESS ASSIGNMENT RANGE		DESTINATION MAC ADDRESS	DESTINATION STATE	SUBSTITUTE DESTINATION MAC ADDRESS 1	DESTINATION STATE
10. 0. 0. 1	10. 32. 0. 0	MAC5	NORMAL	MAC6	NORMAL
10. 32. 0. 1	10. 64. 0. 0	MAC6	NORMAL	MAC5	NORMAL
10. 64. 0. 1	10. 96. 0. 0	MAC5	NORMAL	MAC6	NORMAL
10. 96. 0. 1	10. 128. 0. 0	MAC6	NORMAL	MAC5	NORMAL

FIG. 14

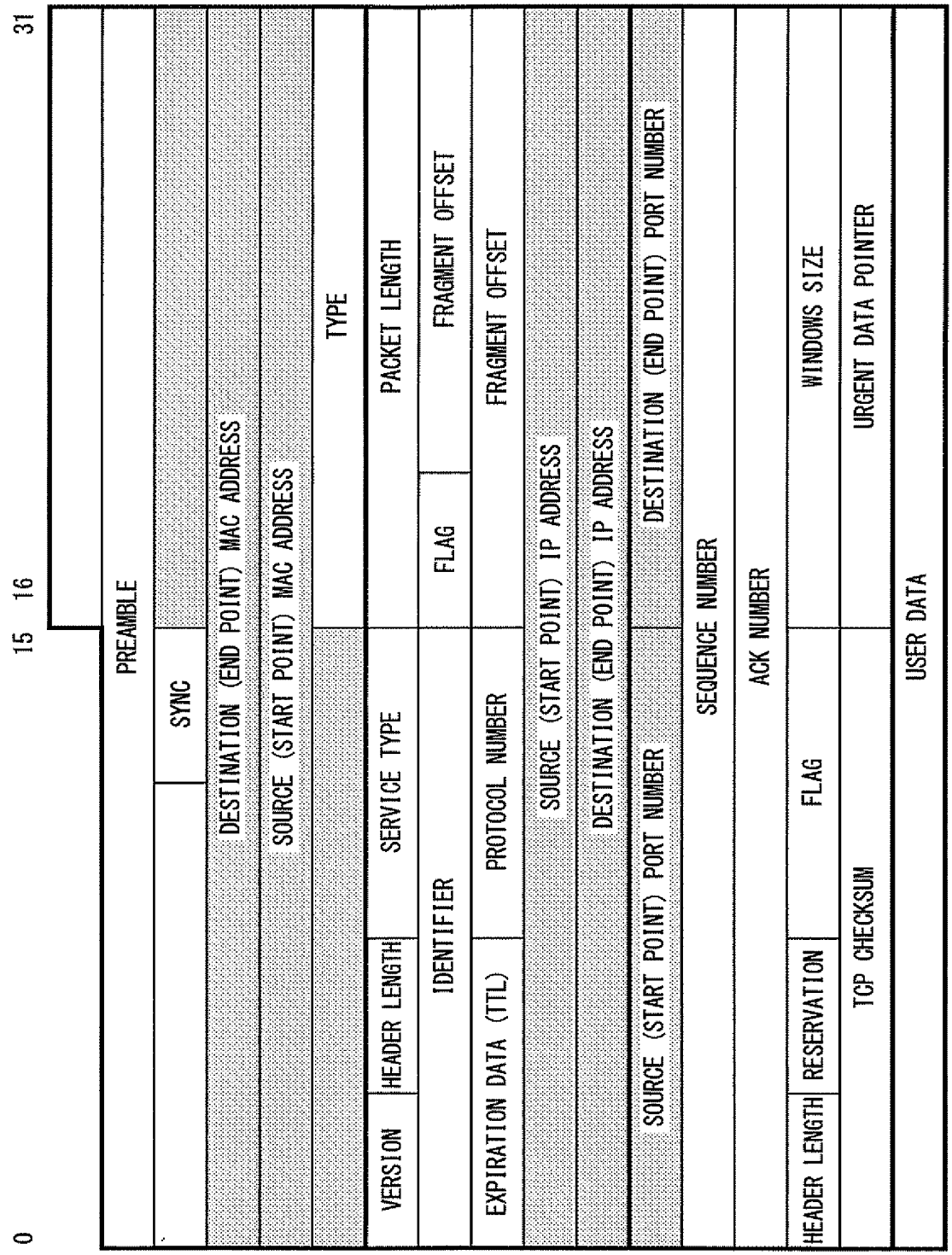

0
15 16
31
ETHERNET
IP HEADER
TCP HEADER
PREAMBLE
SYNC
DESTINATION (END POINT) MAC ADDRESS
SOURCE (START POINT) MAC ADDRESS
TYPE
VERSION
HEADER LENGTH
SERVICE TYPE
PACKET LENGTH
IDENTIFIER
FLAG
FRAGMENT OFFSET
EXPIRATION DATA (TTL)
PROTOCOL NUMBER
FRAGMENT OFFSET
SOURCE (START POINT) IP ADDRESS
DESTINATION (END POINT) IP ADDRESS
SOURCE (START POINT) PORT NUMBER
DESTINATION (END POINT) PORT NUMBER
SEQUENCE NUMBER
ACK NUMBER
HEADER LENGTH
RESERVATION
FLAG
WINDOWS SIZE
TCP CHECKSUM
URGENT DATA POINTER
USER DATA

FIG. 15

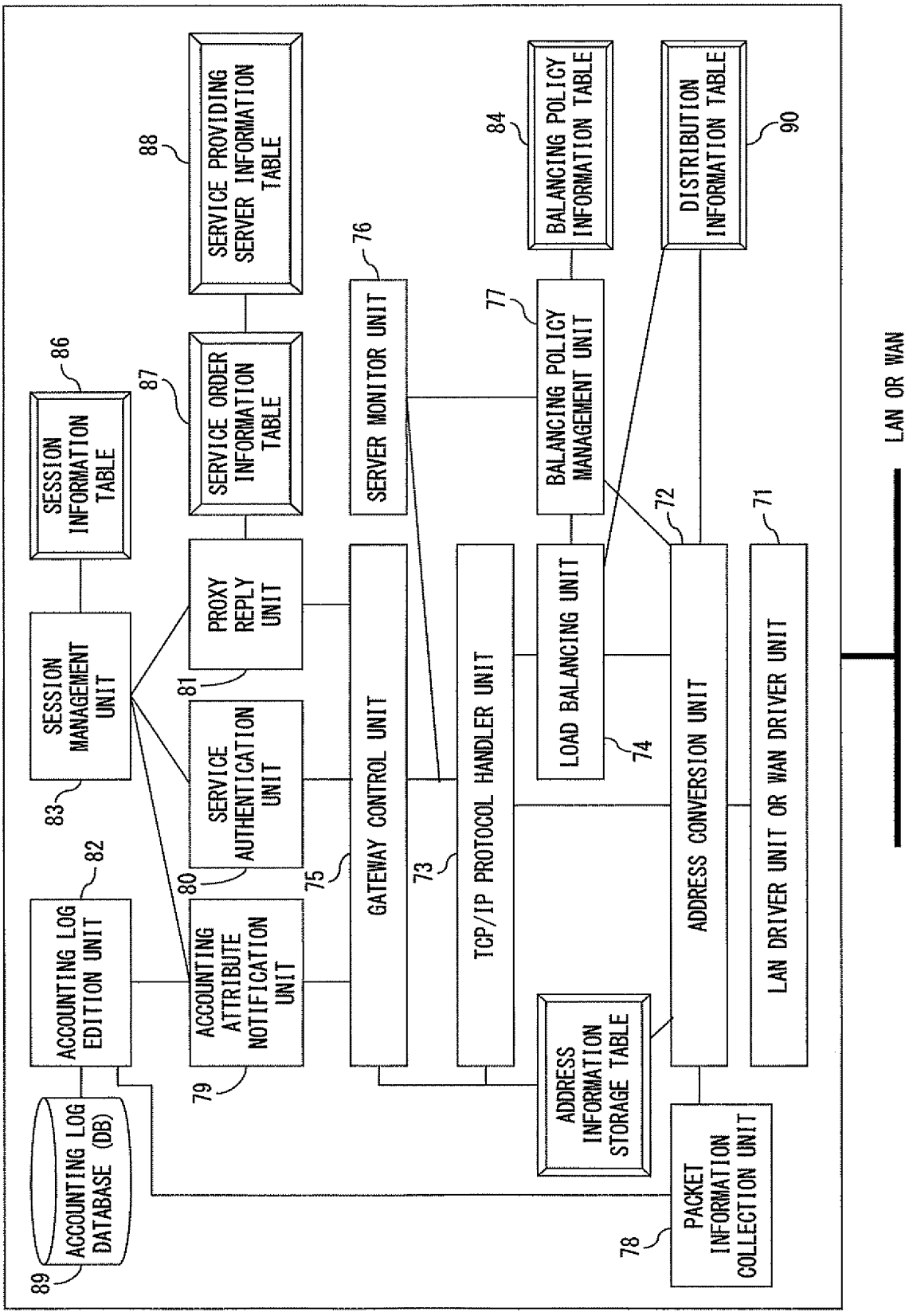

ACCOUNTING LOG DATABASE (DB)
89
ACCOUNTING LOG EDITION UNIT
82
ACCOUNTING ATTRIBUTE NOTIFICATION UNIT
79
SESSION MANAGEMENT UNIT
83
SESSION INFORMATION TABLE
86
PROXY REPLY UNIT
81
SERVICE AUTHENTICATION UNIT
80
SERVICE ORDER INFORMATION TABLE
87
SERVICE PROVIDING SERVER INFORMATION TABLE
88
GATEWAY CONTROL UNIT
75
SERVER MONITOR UNIT
76
TCP/IP PROTOCOL HANDLER UNIT
73
LOAD BALANCING UNIT
74
BALANCING POLICY MANAGEMENT UNIT
77
BALANCING POLICY INFORMATION TABLE
84
ADDRESS INFORMATION STORAGE TABLE
ADDRESS CONVERSION UNIT
72
DISTRIBUTION INFORMATION TABLE
90
LAN DRIVER UNIT OR WAN DRIVER UNIT
71
PACKET INFORMATION COLLECTION UNIT
78
LAN OR WAN

FIG. 16

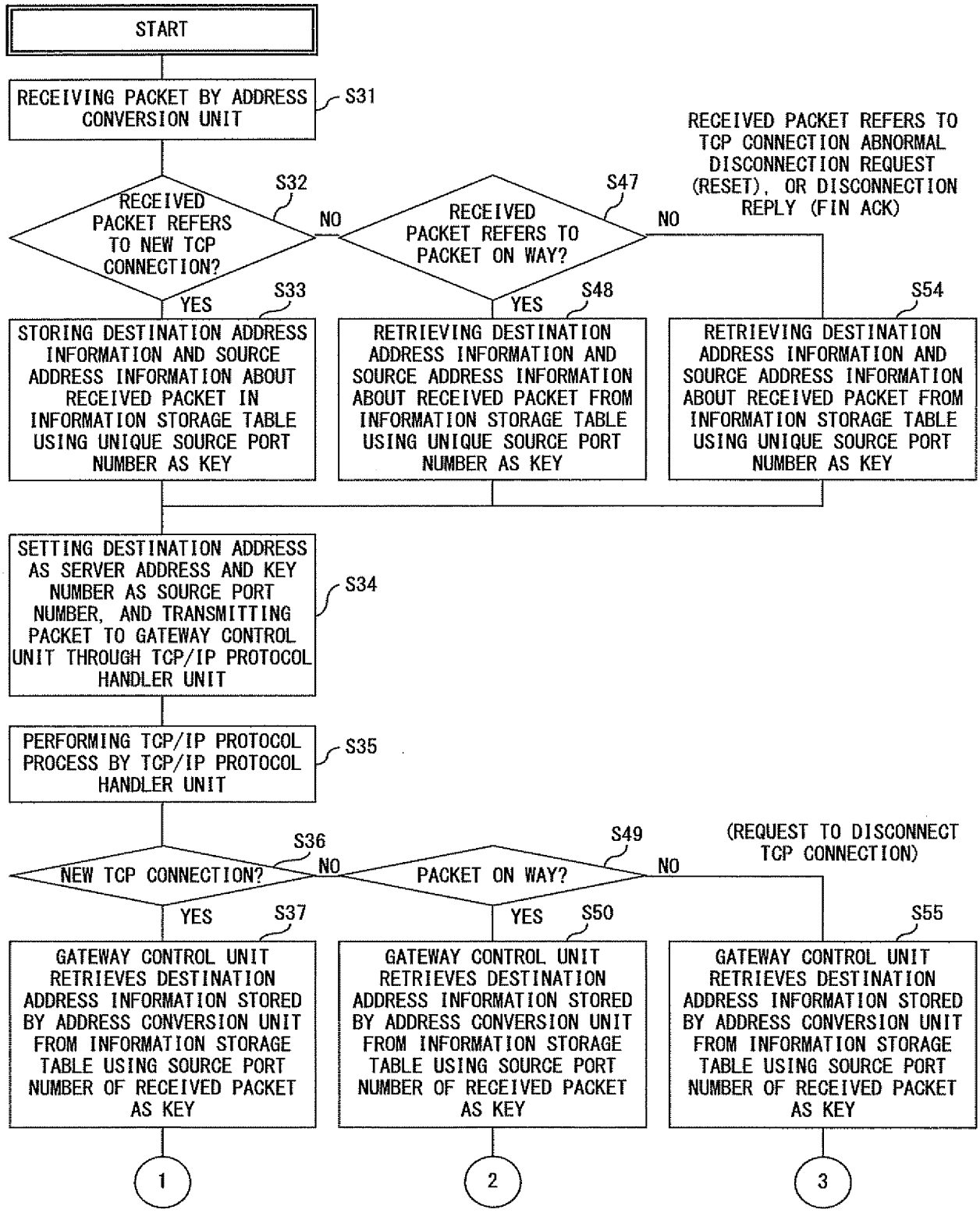

START
RECEIVING PACKET BY ADDRESS CONVERSION UNIT
S31
RECEIVED PACKET REFERS TO NEW TCP CONNECTION?
S32
NO
YES
RECEIVED PACKET REFERS TO PACKET ON WAY?
S47
NO
YES
RECEIVED PACKET REFERS TO TCP CONNECTION ABNORMAL DISCONNECTION REQUEST (RESET), OR DISCONNECTION REPLY (FIN ACK)
S33
STORING DESTINATION ADDRESS INFORMATION AND SOURCE ADDRESS INFORMATION ABOUT RECEIVED PACKET IN INFORMATION STORAGE TABLE USING UNIQUE SOURCE PORT NUMBER AS KEY
S48
RETRIEVING DESTINATION ADDRESS INFORMATION AND SOURCE ADDRESS INFORMATION ABOUT RECEIVED PACKET FROM INFORMATION STORAGE TABLE USING UNIQUE SOURCE PORT NUMBER AS KEY
S54
RETRIEVING DESTINATION ADDRESS INFORMATION AND SOURCE ADDRESS INFORMATION ABOUT RECEIVED PACKET FROM INFORMATION STORAGE TABLE USING UNIQUE SOURCE PORT NUMBER AS KEY
SETTING DESTINATION ADDRESS AS SERVER ADDRESS AND KEY NUMBER AS SOURCE PORT NUMBER, AND TRANSMITTING PACKET TO GATEWAY CONTROL UNIT THROUGH TCP/IP PROTOCOL HANDLER UNIT
S34
PERFORMING TCP/IP PROTOCOL PROCESS BY TCP/IP PROTOCOL HANDLER UNIT
S35
NEW TCP CONNECTION?
S36
NO
YES
PACKET ON WAY?
S49
NO
YES
(REQUEST TO DISCONNECT TCP CONNECTION)
S37
GATEWAY CONTROL UNIT RETRIEVES DESTINATION ADDRESS INFORMATION STORED BY ADDRESS CONVERSION UNIT FROM INFORMATION STORAGE TABLE USING SOURCE PORT NUMBER OF RECEIVED PACKET AS KEY
S50
GATEWAY CONTROL UNIT RETRIEVES DESTINATION ADDRESS INFORMATION STORED BY ADDRESS CONVERSION UNIT FROM INFORMATION STORAGE TABLE USING SOURCE PORT NUMBER OF RECEIVED PACKET AS KEY
S55
GATEWAY CONTROL UNIT RETRIEVES DESTINATION ADDRESS INFORMATION STORED BY ADDRESS CONVERSION UNIT FROM INFORMATION STORAGE TABLE USING SOURCE PORT NUMBER OF RECEIVED PACKET AS KEY
1
2
3

FIG. 17

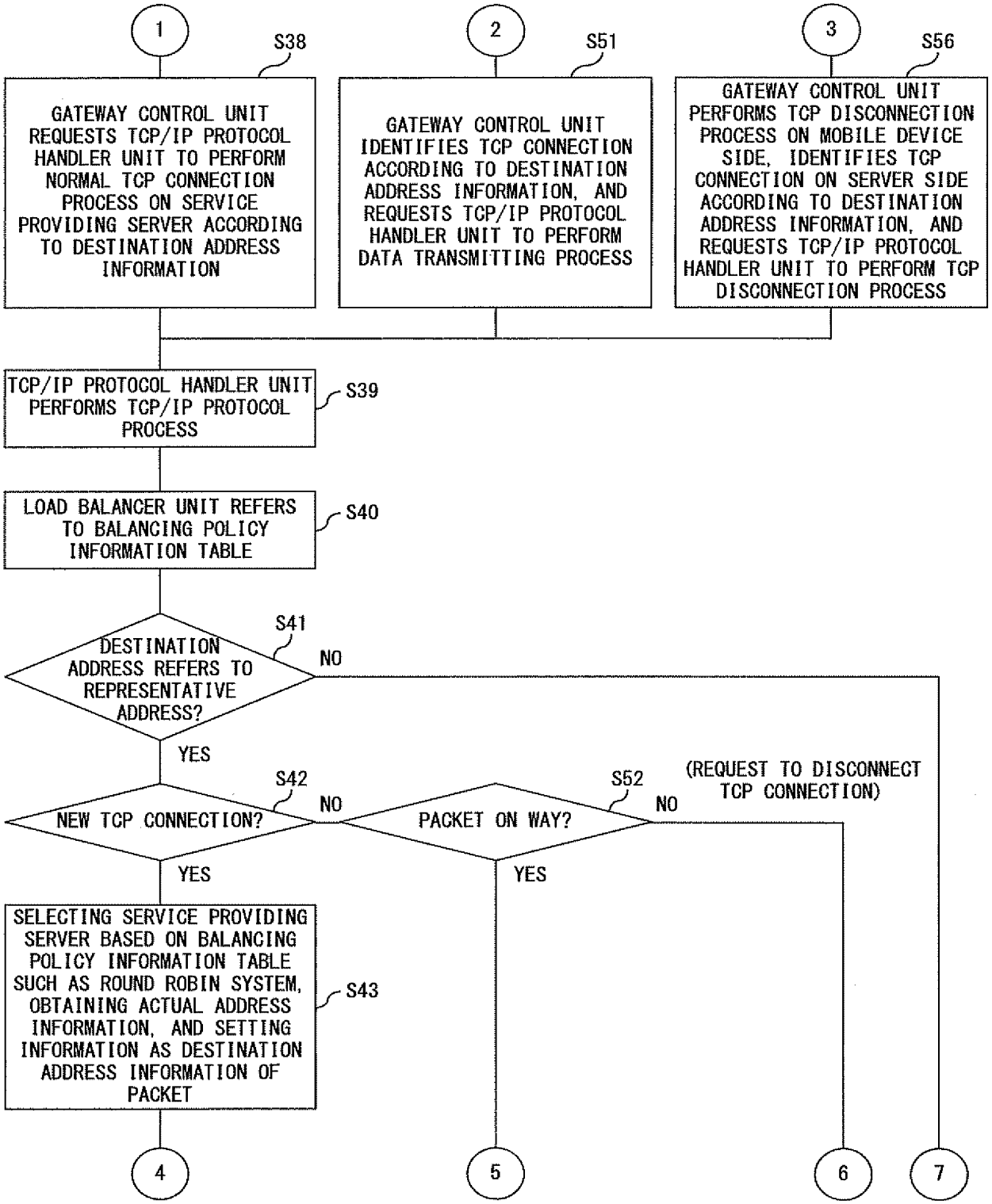

1
S38
GATEWAY CONTROL UNIT REQUESTS TCP/IP PROTOCOL HANDLER UNIT TO PERFORM NORMAL TCP CONNECTION PROCESS ON SERVICE PROVIDING SERVER ACCORDING TO DESTINATION ADDRESS INFORMATION
2
S51
GATEWAY CONTROL UNIT IDENTIFIES TCP CONNECTION ACCORDING TO DESTINATION ADDRESS INFORMATION, AND REQUESTS TCP/IP PROTOCOL HANDLER UNIT TO PERFORM DATA TRANSMITTING PROCESS
3
S56
GATEWAY CONTROL UNIT PERFORMS TCP DISCONNECTION PROCESS ON MOBILE DEVICE SIDE, IDENTIFIES TCP CONNECTION ON SERVER SIDE ACCORDING TO DESTINATION ADDRESS INFORMATION, AND REQUESTS TCP/IP PROTOCOL HANDLER UNIT TO PERFORM TCP DISCONNECTION PROCESS
TCP/IP PROTOCOL HANDLER UNIT PERFORMS TCP/IP PROTOCOL PROCESS
S39
LOAD BALANCER UNIT REFERS TO BALANCING POLICY INFORMATION TABLE
S40
S41
DESTINATION ADDRESS REFERS TO REPRESENTATIVE ADDRESS?
NO
YES
S42
NEW TCP CONNECTION?
NO
YES
S52
PACKET ON WAY?
NO
YES
(REQUEST TO DISCONNECT TCP CONNECTION)
SELECTING SERVICE PROVIDING SERVER BASED ON BALANCING POLICY INFORMATION TABLE SUCH AS ROUND ROBIN SYSTEM, OBTAINING ACTUAL ADDRESS INFORMATION, AND SETTING INFORMATION AS DESTINATION ADDRESS INFORMATION OF PACKET
S43
4
5
6
7

FIG. 18

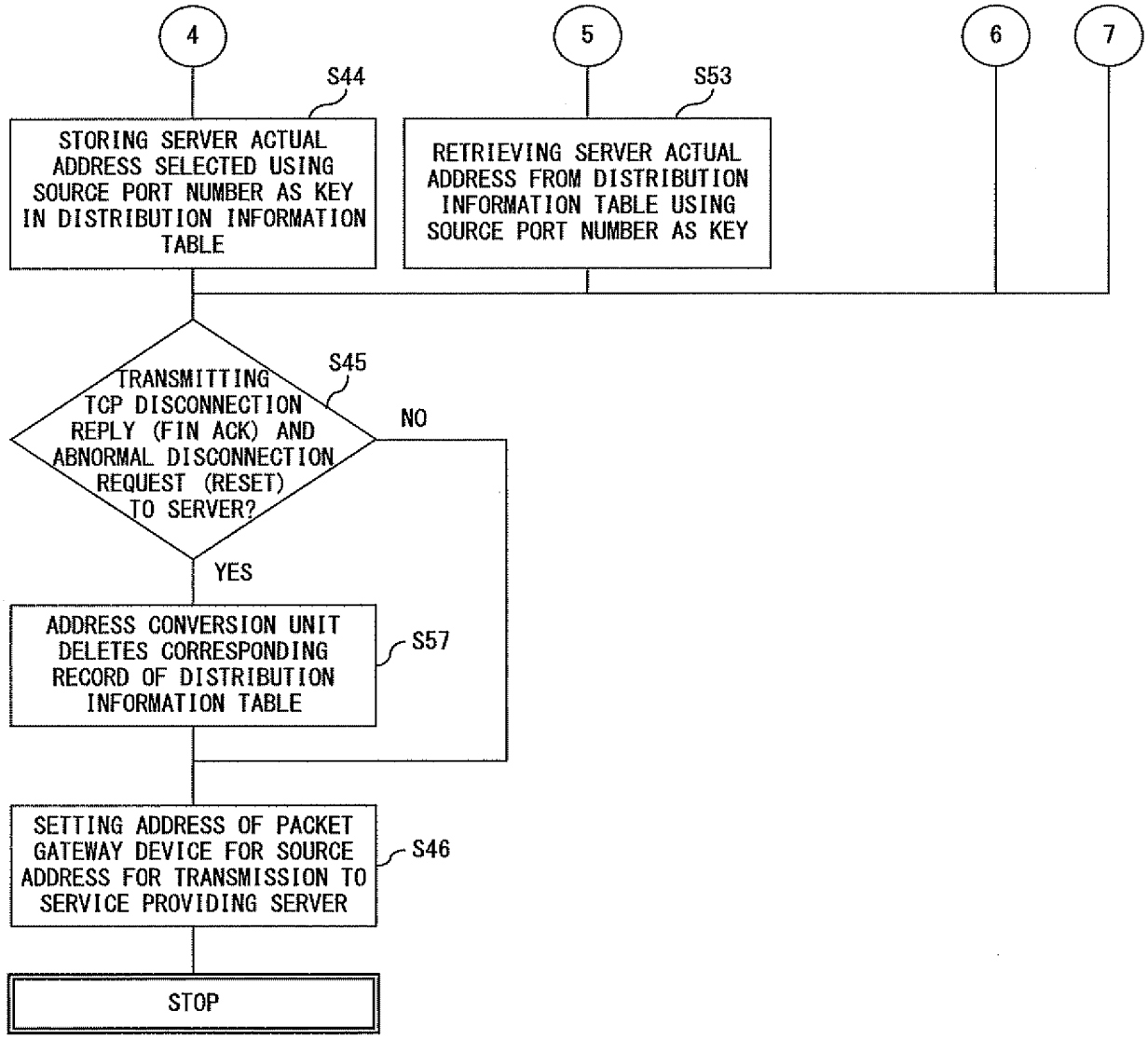

4
5
6
7
S44
STORING SERVER ACTUAL ADDRESS SELECTED USING SOURCE PORT NUMBER AS KEY IN DISTRIBUTION INFORMATION TABLE
S53
RETRIEVING SERVER ACTUAL ADDRESS FROM DISTRIBUTION INFORMATION TABLE USING SOURCE PORT NUMBER AS KEY
S45
TRANSMITTING TCP DISCONNECTION REPLY (FIN ACK) AND ABNORMAL DISCONNECTION REQUEST (RESET) TO SERVER?
NO
YES
ADDRESS CONVERSION UNIT DELETES CORRESPONDING RECORD OF DISTRIBUTION INFORMATION TABLE
S57
SETTING ADDRESS OF PACKET GATEWAY DEVICE FOR SOURCE ADDRESS FOR TRANSMISSION TO SERVICE PROVIDING SERVER
S46
STOP

FIG. 19

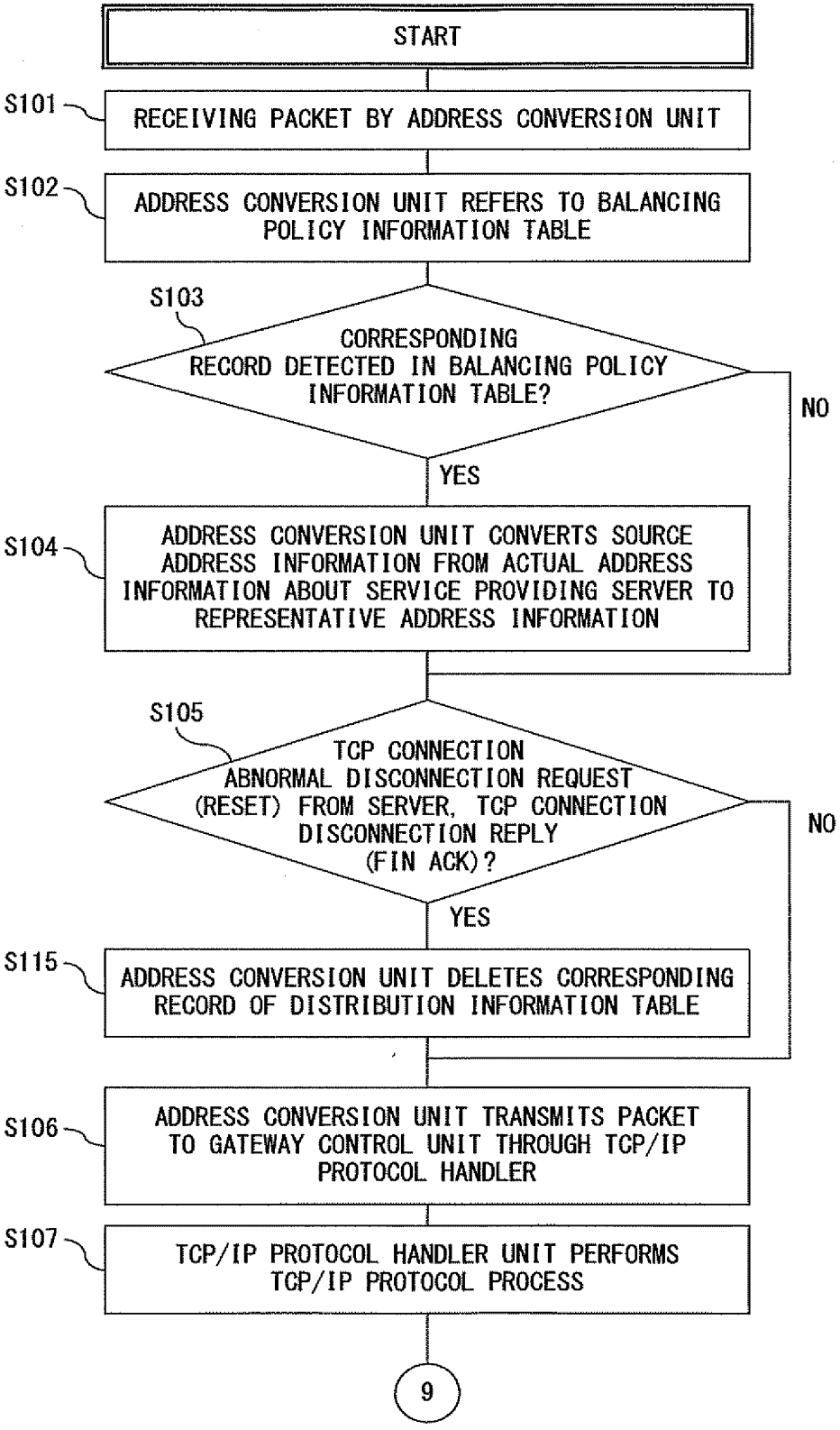

START
S101
RECEIVING PACKET BY ADDRESS CONVERSION UNIT
S102
ADDRESS CONVERSION UNIT REFERS TO BALANCING POLICY INFORMATION TABLE
S103
CORRESPONDING RECORD DETECTED IN BALANCING POLICY INFORMATION TABLE?
NO
YES
S104
ADDRESS CONVERSION UNIT CONVERTS SOURCE ADDRESS INFORMATION FROM ACTUAL ADDRESS INFORMATION ABOUT SERVICE PROVIDING SERVER TO REPRESENTATIVE ADDRESS INFORMATION
S105
TCP CONNECTION ABNORMAL DISCONNECTION REQUEST (RESET) FROM SERVER, TCP CONNECTION DISCONNECTION REPLY (FIN ACK)?
NO
YES
S115
ADDRESS CONVERSION UNIT DELETES CORRESPONDING RECORD OF DISTRIBUTION INFORMATION TABLE
S106
ADDRESS CONVERSION UNIT TRANSMITS PACKET TO GATEWAY CONTROL UNIT THROUGH TCP/IP PROTOCOL HANDLER
S107
TCP/IP PROTOCOL HANDLER UNIT PERFORMS TCP/IP PROTOCOL PROCESS
9

FIG. 20

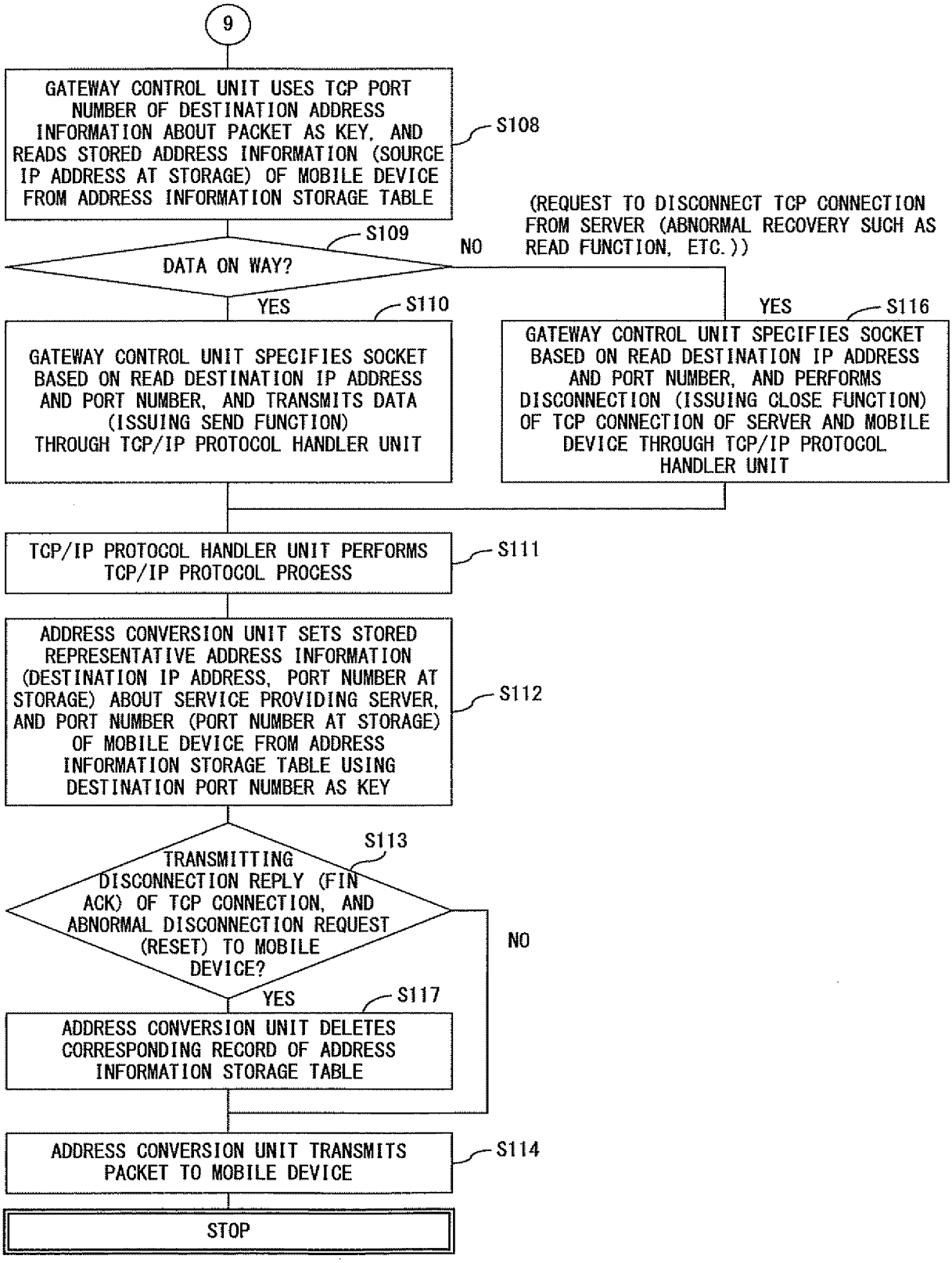

9
GATEWAY CONTROL UNIT USES TCP PORT NUMBER OF DESTINATION ADDRESS INFORMATION ABOUT PACKET AS KEY, AND READS STORED ADDRESS INFORMATION (SOURCE IP ADDRESS AT STORAGE) OF MOBILE DEVICE FROM ADDRESS INFORMATION STORAGE TABLE
S108
DATA ON WAY?
S109
NO
(REQUEST TO DISCONNECT TCP CONNECTION FROM SERVER (ABNORMAL RECOVERY SUCH AS READ FUNCTION, ETC.))
YES
S110
GATEWAY CONTROL UNIT SPECIFIES SOCKET BASED ON READ DESTINATION IP ADDRESS AND PORT NUMBER, AND TRANSMITS DATA (ISSUING SEND FUNCTION) THROUGH TCP/IP PROTOCOL HANDLER UNIT
YES
S116
GATEWAY CONTROL UNIT SPECIFIES SOCKET BASED ON READ DESTINATION IP ADDRESS AND PORT NUMBER, AND PERFORMS DISCONNECTION (ISSUING CLOSE FUNCTION) OF TCP CONNECTION OF SERVER AND MOBILE DEVICE THROUGH TCP/IP PROTOCOL HANDLER UNIT
TCP/IP PROTOCOL HANDLER UNIT PERFORMS TCP/IP PROTOCOL PROCESS
S111
ADDRESS CONVERSION UNIT SETS STORED REPRESENTATIVE ADDRESS INFORMATION (DESTINATION IP ADDRESS, PORT NUMBER AT STORAGE) ABOUT SERVICE PROVIDING SERVER, AND PORT NUMBER (PORT NUMBER AT STORAGE) OF MOBILE DEVICE FROM ADDRESS INFORMATION STORAGE TABLE USING DESTINATION PORT NUMBER AS KEY
S112
TRANSMITTING DISCONNECTION REPLY (FIN ACK) OF TCP CONNECTION, AND ABNORMAL DISCONNECTION REQUEST (RESET) TO MOBILE DEVICE?
S113
NO
YES
S117
ADDRESS CONVERSION UNIT DELETES CORRESPONDING RECORD OF ADDRESS INFORMATION STORAGE TABLE
ADDRESS CONVERSION UNIT TRANSMITS PACKET TO MOBILE DEVICE
S114
STOP

FIG. 21

KEY INFORMATION	STORED ADDRESS INFORMATION			
	SOURCE IP ADDRESS	SOURCE PORT NUMBER	DESTINATION IP ADDRESS	DESTINATION PORT NUMBER
1	10. 32. 0. 1	8081	10. 33. 0. 1	8080
2	10. 32. 0. 2	8081	10. 33. 0. 2	8080
3	10. 32. 0. 3	8081	10. 33. 0. 3	8080
4	10. 32. 0. 4	8081	10. 33. 0. 4	8080

FIG. 22

FIG. 23

SERVICE TYPE	SERVICE REPRESENTATIVE IP ADDRESS	NUMBER OF ACTUAL SERVERS	ACTUAL SERVER 1 IP ADDRESS	SERVER STATE	ACTUAL SERVER 2 IP ADDRESS	SERVER STATE
WAP	10. 33. 0. 1	2	10. 33. 1. 10	NORMAL	10. 33. 1. 11	NORMAL
MAIL	10. 33. 0. 2	2	10. 33. 1. 20	NORMAL	10. 33. 1. 21	NORMAL
CHAT	10. 33. 0. 3	2	10. 33. 1. 30	NORMAL	10. 33. 1. 31	NORMAL
EXTERNAL CONNECTION	10. 33. 0. 4	2	10. 33. 1. 40	NORMAL	10. 33. 1. 41	NORMAL

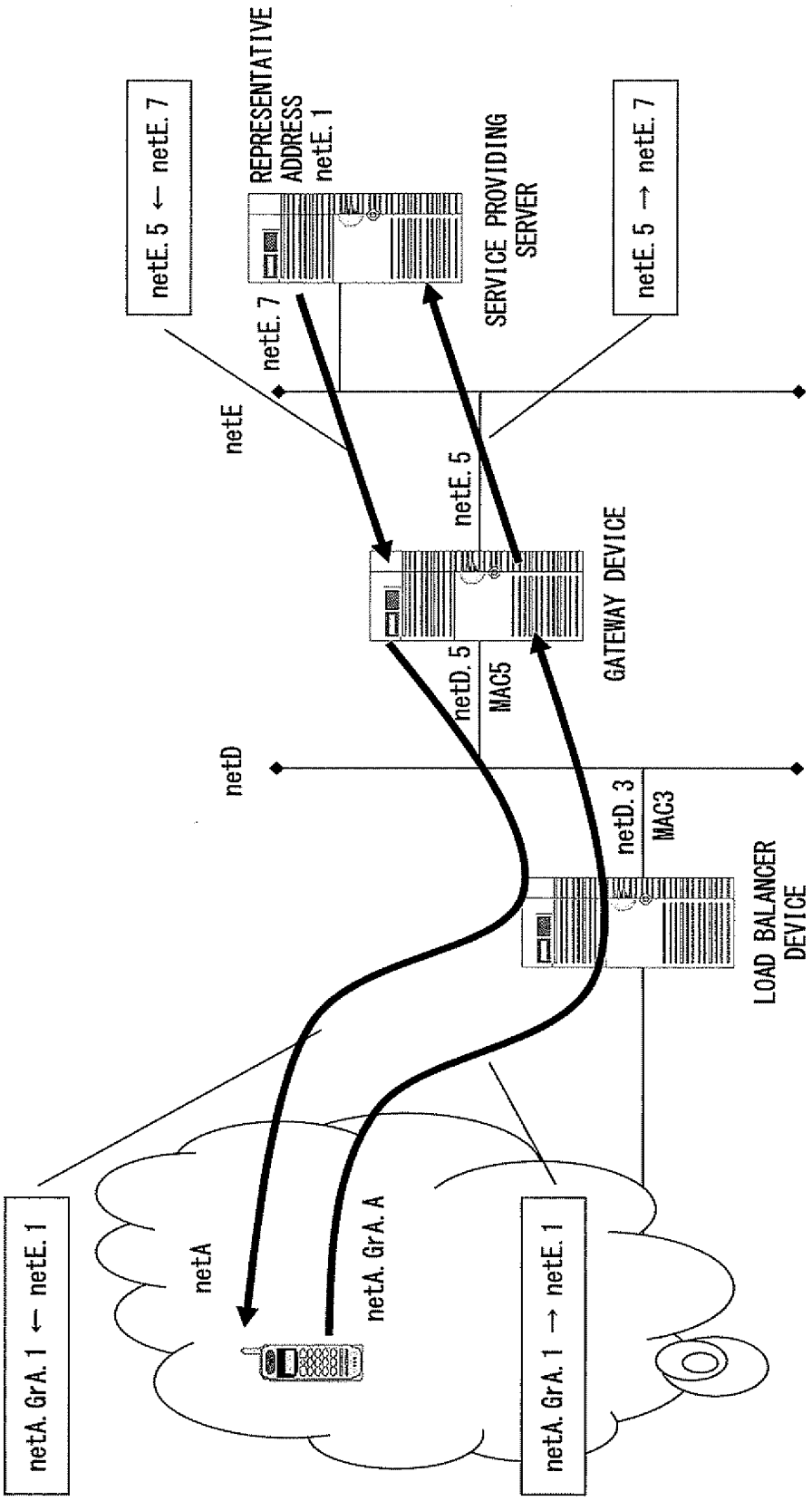

netE. 5 ← netE. 7
REPRESENTATIVE ADDRESS netE. 1
SERVICE PROVIDING SERVER
netE. 5 → netE. 7
netE. 7
netE
netE. 5
GATEWAY DEVICE
netD. 5
MAC5
netD
netD. 3
MAC3
LOAD BALANCER DEVICE
netA. GrA. 1 ← netE. 1
netA
netA. GrA. A
netA. GrA. 1 → netE. 1

FIG. 24

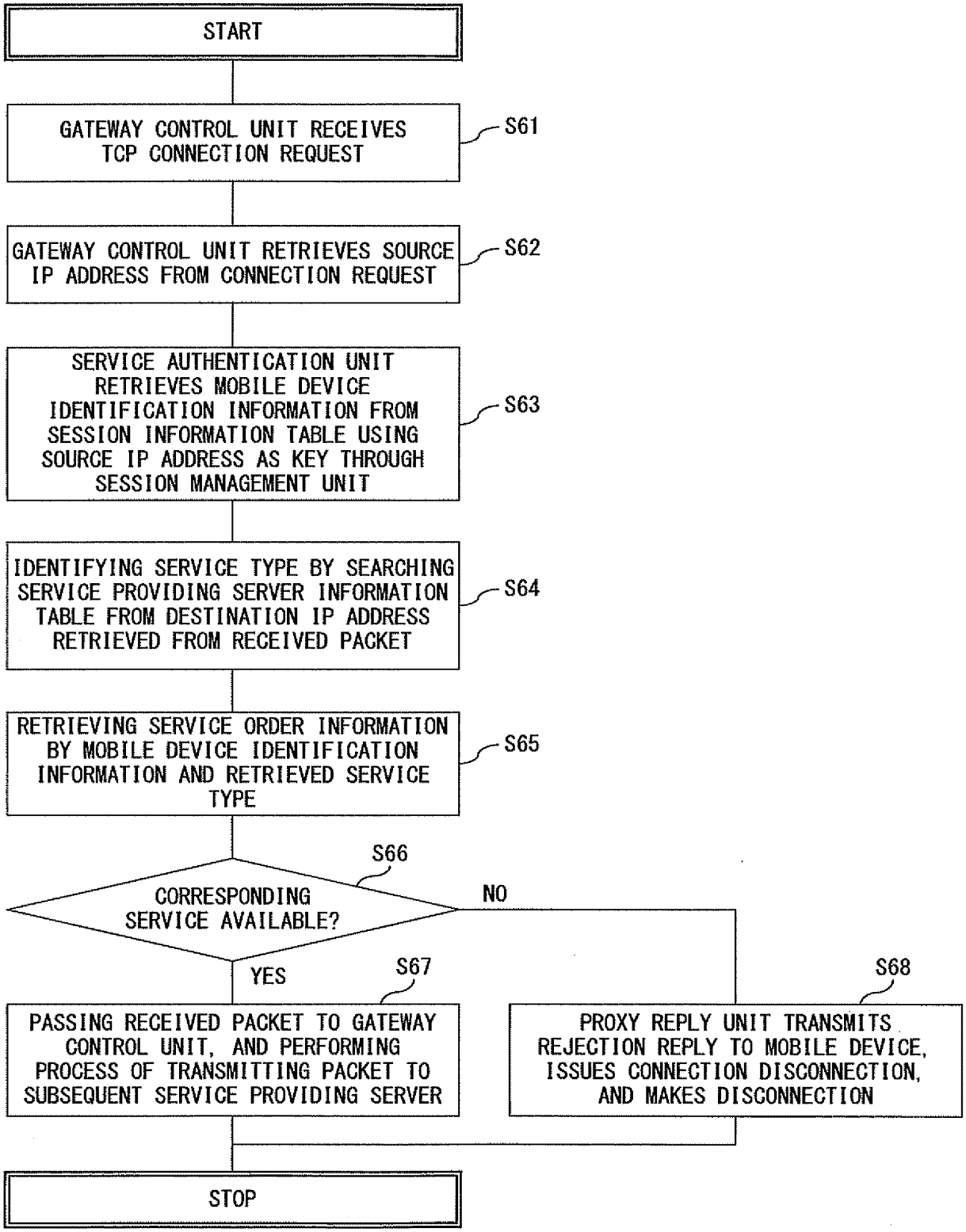

START
GATEWAY CONTROL UNIT RECEIVES TCP CONNECTION REQUEST
S61
GATEWAY CONTROL UNIT RETRIEVES SOURCE IP ADDRESS FROM CONNECTION REQUEST
S62
SERVICE AUTHENTICATION UNIT RETRIEVES MOBILE DEVICE IDENTIFICATION INFORMATION FROM SESSION INFORMATION TABLE USING SOURCE IP ADDRESS AS KEY THROUGH SESSION MANAGEMENT UNIT
S63
IDENTIFYING SERVICE TYPE BY SEARCHING SERVICE PROVIDING SERVER INFORMATION TABLE FROM DESTINATION IP ADDRESS RETRIEVED FROM RECEIVED PACKET
S64
RETRIEVING SERVICE ORDER INFORMATION BY MOBILE DEVICE IDENTIFICATION INFORMATION AND RETRIEVED SERVICE TYPE
S65
S66
CORRESPONDING SERVICE AVAILABLE?
NO
YES
S67
PASSING RECEIVED PACKET TO GATEWAY CONTROL UNIT, AND PERFORMING PROCESS OF TRANSMITTING PACKET TO SUBSEQUENT SERVICE PROVIDING SERVER
S68
PROXY REPLY UNIT TRANSMITS REJECTION REPLY TO MOBILE DEVICE, ISSUES CONNECTION DISCONNECTION, AND MAKES DISCONNECTION
STOP

FIG. 25

MOBILE DEVICE IDENTIFICATION INFORMATION	SERVICE ORDER INFORMATION			
	WAP	MAIL	CHAT	EXTERNAL CONNECTION
F50200001	OK	OK	OK	NG
F50200002	OK	OK	OK	NG
F50200003	OK	OK	OK	NG
F50200004	OK	OK	OK	OK

FIG. 26

SERVICE PROVIDING SERVER INFORMATION	
SERVICE TYPE	SERVICE REPRESENTATIVE IP ADDRESS
WAP	10. 33. 0. 1
MAIL	10. 33. 0. 2
CHAT	10. 33. 0. 3
EXTERNAL CONNECTION	10. 33. 0. 4

FIG. 27

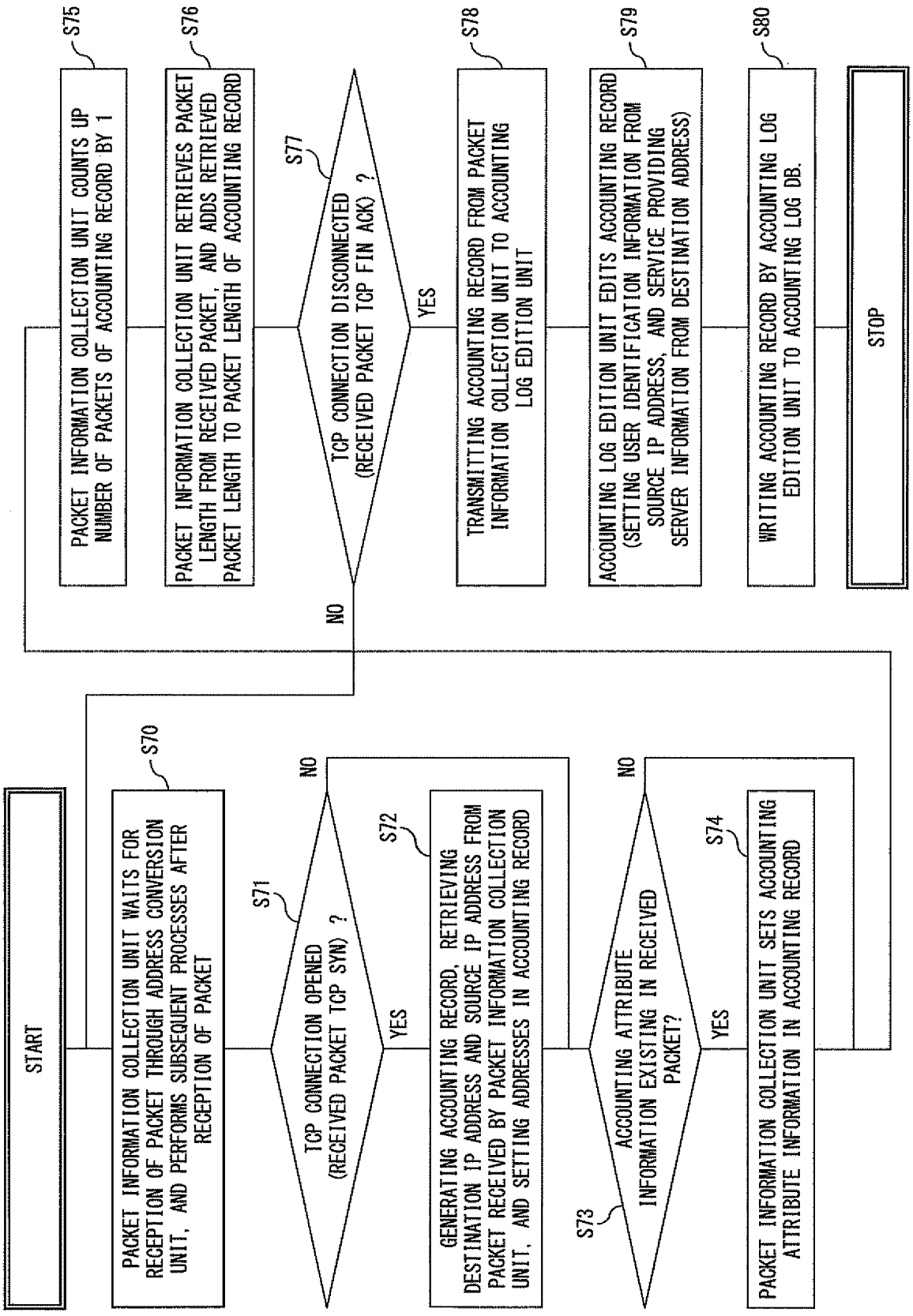

START
PACKET INFORMATION COLLECTION UNIT WAITS FOR RECEPTION OF PACKET THROUGH ADDRESS CONVERSION UNIT, AND PERFORMS SUBSEQUENT PROCESSES AFTER RECEPTION OF PACKET
S70
TCP CONNECTION OPENED (RECEIVED PACKET TCP SYN) ?
S71
NO
YES
GENERATING ACCOUNTING RECORD, RETRIEVING DESTINATION IP ADDRESS AND SOURCE IP ADDRESS FROM PACKET RECEIVED BY PACKET INFORMATION COLLECTION UNIT, AND SETTING ADDRESSES IN ACCOUNTING RECORD
S72
ACCOUNTING ATTRIBUTE INFORMATION EXISTING IN RECEIVED PACKET?
S73
NO
YES
PACKET INFORMATION COLLECTION UNIT SETS ACCOUNTING ATTRIBUTE INFORMATION IN ACCOUNTING RECORD
S74
PACKET INFORMATION COLLECTION UNIT COUNTS UP NUMBER OF PACKETS OF ACCOUNTING RECORD BY 1
S75
PACKET INFORMATION COLLECTION UNIT RETRIEVES PACKET LENGTH FROM RECEIVED PACKET, AND ADDS RETRIEVED PACKET LENGTH TO PACKET LENGTH OF ACCOUNTING RECORD
S76
TCP CONNECTION DISCONNECTED (RECEIVED PACKET TCP FIN ACK) ?
S77
NO
YES
TRANSMITTING ACCOUNTING RECORD FROM PACKET INFORMATION COLLECTION UNIT TO ACCOUNTING LOG EDITION UNIT
S78
ACCOUNTING LOG EDITION UNIT EDITS ACCOUNTING RECORD (SETTING USER IDENTIFICATION INFORMATION FROM SOURCE IP ADDRESS, AND SERVICE PROVIDING SERVER INFORMATION FROM DESTINATION ADDRESS)
S79
WRITING ACCOUNTING RECORD BY ACCOUNTING LOG EDITION UNIT TO ACCOUNTING LOG DB.
S80
STOP

FIG. 28

FIG. 29

MOBILE DEVICE IDENTIFICATION INFORMATION	SERVICE PROVIDING SERVER INFORMATION		ACCOUNTING ATTRIBUTE INFORMATION		ACCOUNTING INFORMATION	
	SERVICE TYPE	SERVICE REPRESENTATIVE IP ADDRESS	PROXY ACCOUNTING	CONNECTION SERVER URL	NUMBER OF PACKETS	TOTAL PACKET LENGTH
F50200001	WAP	10. 33. 0. 1	-	-	5	500
F50200002	MAIL	10. 33. 0. 2	-	-	6	600
F50200003	CHAT	10. 33. 0. 3	-	-	7	700
F50200004	EXTERNAL CONNECTION	10. 33. 0. 4	YES	WWW. Hoo. com	3	300

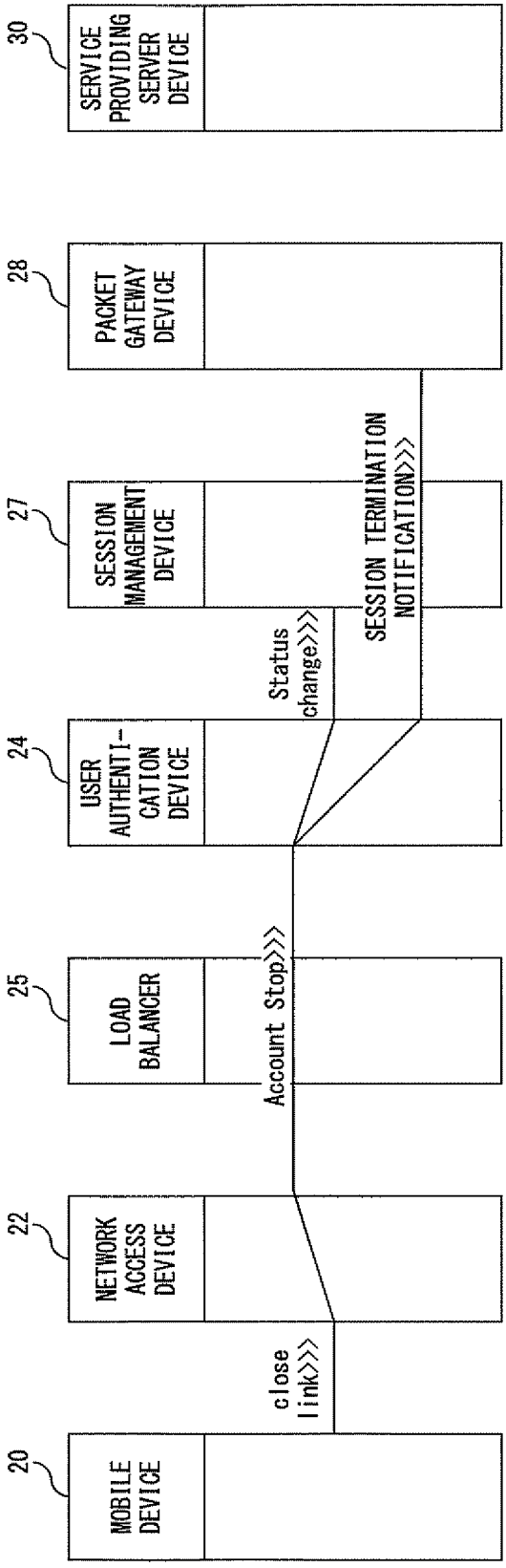

30
SERVICE PROVIDING SERVER DEVICE
28
PACKET GATEWAY DEVICE
27
SESSION MANAGEMENT DEVICE
24
USER AUTHENTI-CATION DEVICE
25
LOAD BALANCER
22
NETWORK ACCESS DEVICE
20
MOBILE DEVICE
Status change>>>
SESSION TERMINATION NOTIFICATION>>>
Account Stop>>>
close link>>>

FIG. 30

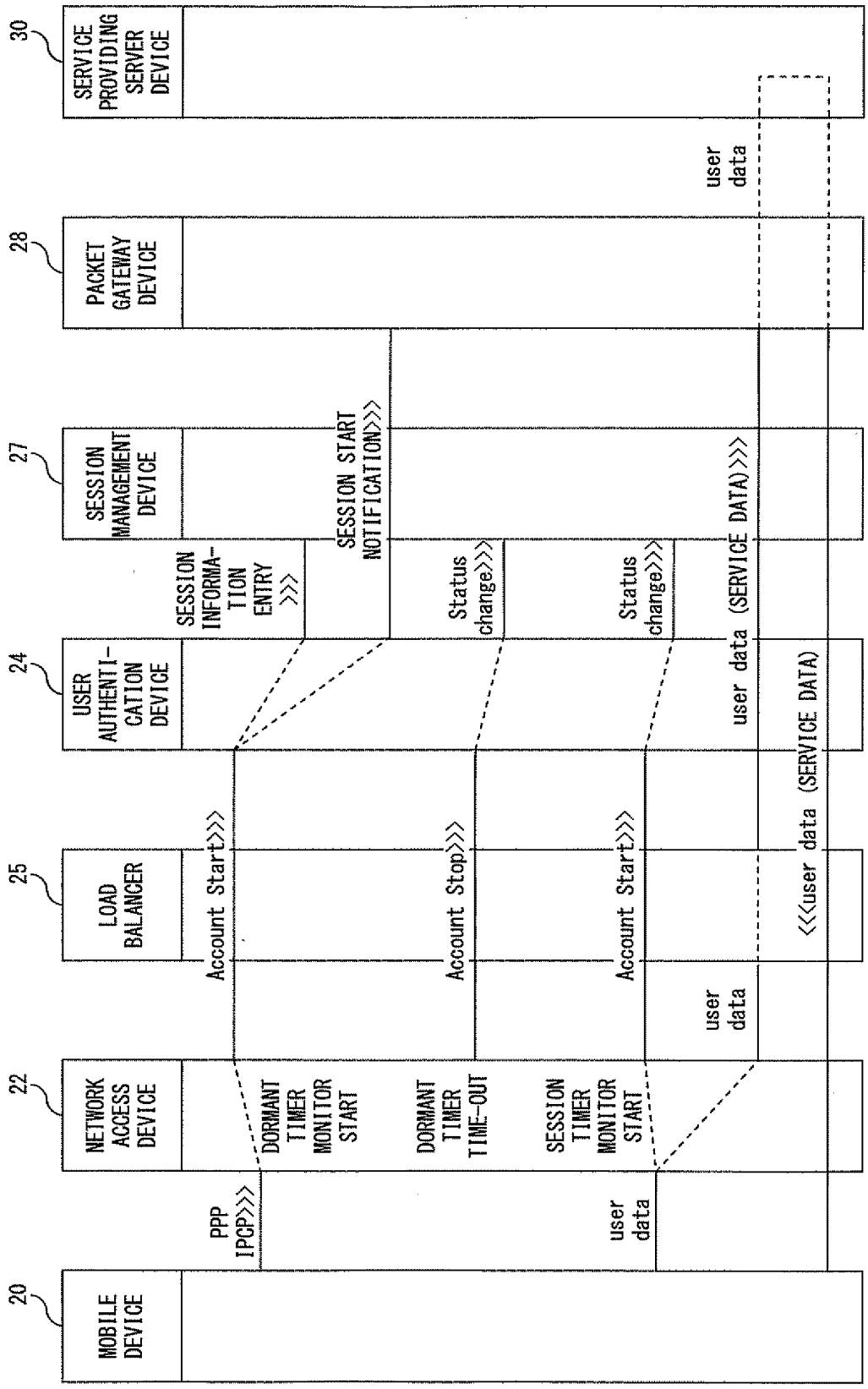

20
MOBILE DEVICE
22
NETWORK ACCESS DEVICE
25
LOAD BALANCER
24
USER AUTHENTI-CATION DEVICE
27
SESSION MANAGEMENT DEVICE
28
PACKET GATEWAY DEVICE
30
SERVICE PROVIDING SERVER DEVICE
PPP IPCP>>>
DORMANT TIMER MONITOR START
DORMANT TIMER TIME-OUT
SESSION TIMER MONITOR START
user data
Account Start>>>
Account Stop>>>
Account Start>>>
SESSION INFORMA-TION ENTRY >>>
SESSION START NOTIFICATION>>>
Status change>>>
Status change>>>
user data (SERVICE DATA)>>>
user data
<<<user data (SERVICE DATA)
user data

FIG. 31

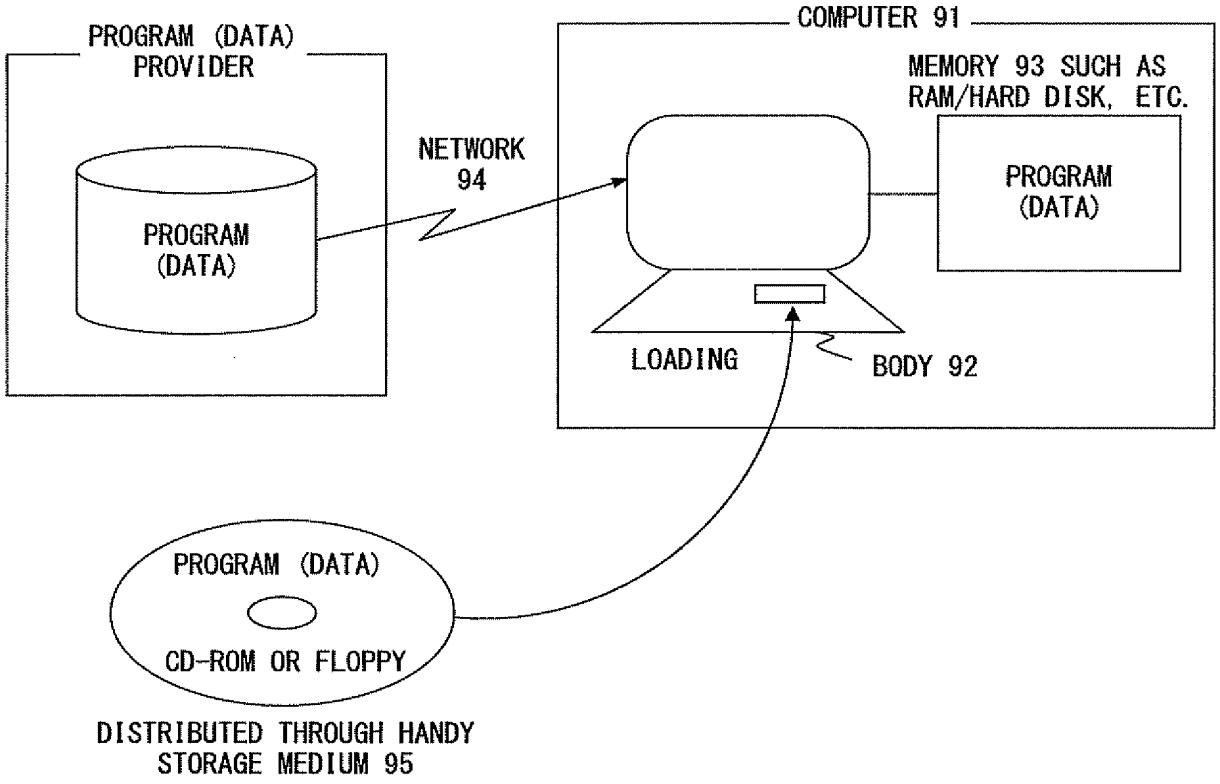

PROGRAM (DATA)
PROVIDER
PROGRAM
(DATA)
NETWORK
94
COMPUTER 91
MEMORY 93 SUCH AS
RAM/HARD DISK, ETC.
PROGRAM
(DATA)
LOADING
BODY 92
PROGRAM (DATA)
CD-ROM OR FLOPPY
DISTRIBUTED THROUGH HANDY
STORAGE MEDIUM 95

FIG. 32

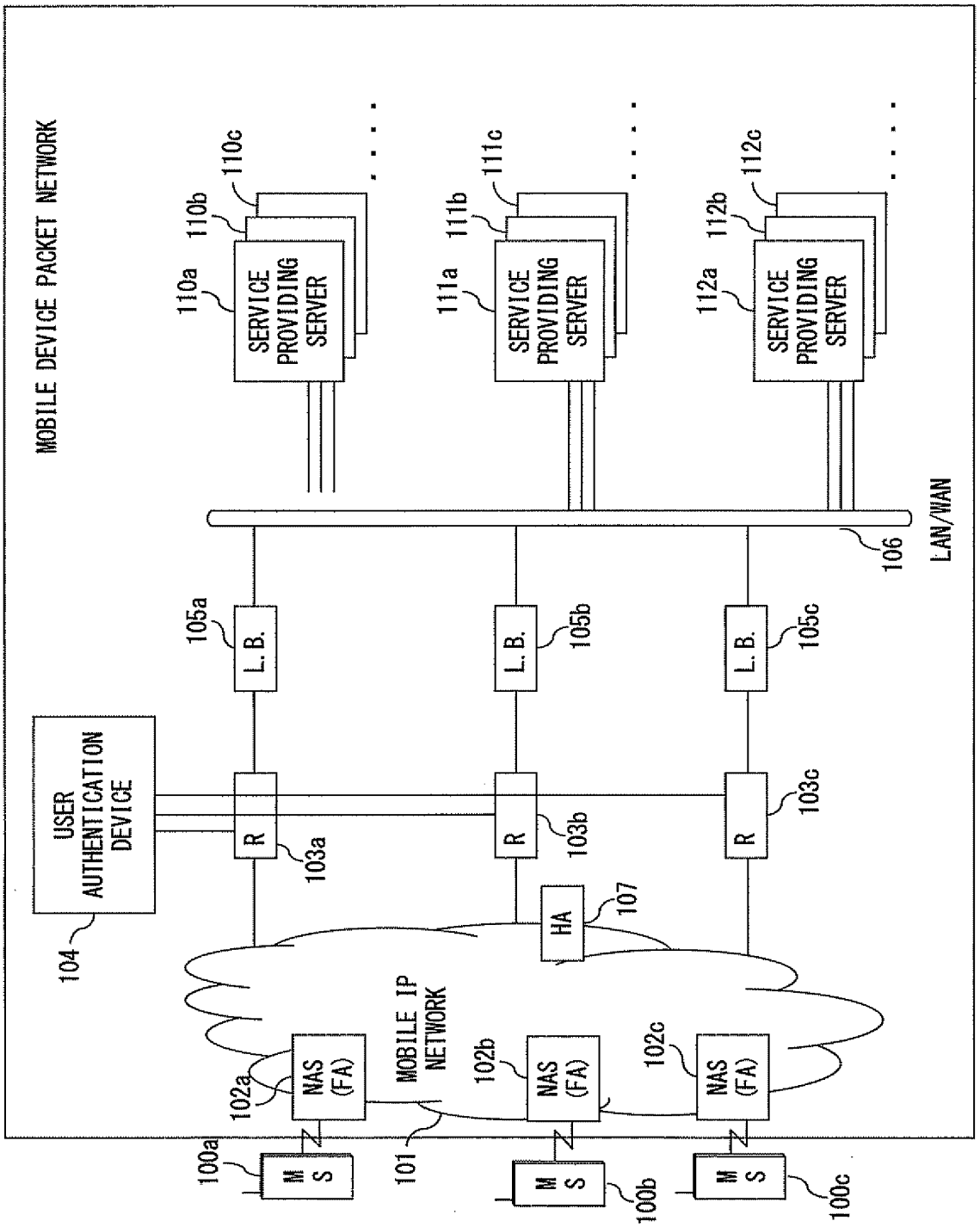

MOBILE DEVICE PACKET NETWORK
SERVICE PROVIDING SERVER
110a
110b
110c
111a
111b
111c
112a
112b
112c
LAN/WAN
106
L. B.
105a
105b
105c
USER AUTHENTICATION DEVICE
104
R
103a
103b
103c
HA
107
MOBILE IP NETWORK
NAS (FA)
102a
102b
102c
MS
100a
100b
100c
101

FIG. 33

特許協力条約に基づく国際出願願書 0150774/1538

原本（出願用）－印刷日時 2001年07月10日（10.07.2001）火曜日 14時27分48秒

0 0-1	受理官庁記入欄 国際出願番号.	
0-2	国際出願日	
0-3	(受付印)	
0-4 0-4-1	様式-PCT/RO/101 この特許協力条約に基づく国際出願願書は、 右記によって作成された。	PCT-EASY Version 2.91 (updated 01.01.2001)
0-5	申立て 出願人は、この国際出願が特許協力条約に従って処理されることを請求する。	
0-6	出願人によって指定された受理官庁	日本国特許庁 (RO/JP)
0-7	出願人又は代理人の書類記号	0150774/1538
I	発明の名称	移動機通信システムおよび通信方法 (1)
II II-1 II-2 II-4ja II-4en II-5ja II-5en II-6 II-7 II-8 II-9	出願人 この欄に記載した者は 右の指定国についての出願人である。 名称 Name あて名: Address: 国籍（国名） 住所（国名） 電話番号 ファクシミリ番号	 出願人である (applicant only) 米国を除くすべての指定国 (all designated States except US) 富士通株式会社 FUJITSU LIMITED 211-8588 日本国 神奈川県 川崎市中原区 上小田中4丁目1番1号 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8588 Japan 日本国 JP 日本国 JP 044-754-3798 044-754-3536

PCT 10.7.01 受領印

III-1	その他の出願人又は発明者	
III-1-1	この欄に記載した者は	出願人及び発明者である（applicant and inventor）
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III-1-7	住所（国名）	日本国 JP
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III-2-1	この欄に記載した者は	出願人及び発明者である（applicant and inventor）
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III-2-4ja	氏名（姓名）	塚原 哲矢
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III-2-5en	Address:	c/o FUJITSU LIMITED, 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8588 Japan
III-2-6	国籍（国名）	日本国 JP
III-2-7	住所（国名）	日本国 JP
III-3	その他の出願人又は発明者	
III-3-1	この欄に記載した者は	出願人及び発明者である（applicant and inventor）
III-3-2	右の指定国についての出願人である。	米国のみ（US only）
III-3-4ja	氏名（姓名）	木村 雅也
III-3-4en	Name (LAST, First)	KIMURA, Masaya
III-3-5ja	あて名：	222-0033 日本国 神奈川県 横浜市港北区 新横浜二丁目15番16 株式会社富士通ハイパーソフトテクノロジ内
III-3-5en	Address:	c/o FUJITSU HYPER SOFTWARE TECHNOLOGIES LIMITED, 15-16, Shinyokohama 2-chome, Kohoku-ku, Yokohama-shi, Kanagawa 222-0033 Japan
III-3-6	国籍（国名）	日本国 JP
III-3-7	住所（国名）	日本国 JP

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IV-1	代理人又は共通の代表者、通知のあ て名 下記の者は国際機関において右記のごとく出願人のために行動する。	代理人 (agent)
IV-1-1ja	氏名(姓名)	大菅 義之
IV-1-1en	Name (LAST, First)	OSUGA, Yoshiyuki
IV-1-2ja	あ て名:	102-0084 日本国 東京都 千代田区 二番町8番地２０ 二番町ビル3F
IV-1-2en	Address:	3rd Fl., Nibancho Bldg., 8-20, Nibancho, Chiyoda-ku, Tokyo 102-0084 Japan
IV-1-3	電話番号	03-3238-0031
IV-1-4	ファクシミリ番号	03-3238-0034
IV-1-5	電子メール	osugapat@mb.infoweb.ne.jp
V	国の指定	
V-1	広域特許 (他の種類の保護又は取扱いを求める場合には括弧内に記載する。)	EP: DE FR GB
V-2	国内特許 (他の種類の保護又は取扱いを求める場合には括弧内に記載する。)	CN JP KR US
V-5	指定の確認の宣言 出願人は、上記の指定に加えて、規則4.9(b)の規定に基づき、特許協力条約のもとで認められる他の全ての国の指定を行う。ただし、V-6欄に示した国の指定を除く。出願人は、これらの追加される指定が確認を条件としていること、並びに優先日から15月が経過する前にその確認がなされない指定は、この期間の経過時に、出願人によって取り下げられたものとみなされることを宣言する。	
V-6	指定の確認から除かれる国	なし (NONE)
VI	優先権 主張	なし (NONE)
VII-1	特定された国際調査機関(ISA)	日本国特許庁 (ISA/JP)

	照合欄	用紙の枚数	添付された電子データ
VIII-1	願書	4	--
VIII-2	明細書	45	--
VIII-3	請求の範囲	7	--
VIII-4	要約	1	abst1538.txt
VIII-5	図面	33	--
VIII-7	合計	90	

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	添付書類	添付	添付された電子データ
VIII-8	手数料計算用紙	✓	--
VIII-9	別個の記名押印された委任状	✓	--
VIII-10	包括委任状の写し	✓	--
VIII-16	PCT-EASYディスク	--	フレキシブルディスク ②
VIII-17	その他	納付する手数料に相当する特許印紙を貼付した書面 ③	--
VIII-17	その他	国際事務局の口座への振込みを証明する書面 ④	--
VIII-18	要約書とともに提示する図の番号	2	
VIII-19	国際出願の使用言語名：	日本語（Japanese）	
IX-1	提出者の記名押印		
IX-1-1	氏名（姓名）	大菅 義之 ⑤	

受理官庁記入欄

10-1	国際出願として提出された書類の実際の受理の日	
10-2 10-2-1 10-2-2	図面： 受理された 不足図面がある	
10-3	国際出願として提出された書類を補完する書類又は図面であってその後期間内に提出されたものの実際の受理の日（訂正日）	
10-4	特許協力条約第11条(2)に基づく必要な補完の期間内の受理の日	
10-5	出願人により特定された国際調査機関	ISA/JP
10-6	調査手数料未払いにつき、国際調査機関に調査用写しを送付していない	

国際事務局記入欄

11-1	記録原本の受理の日	

① Mobile Device Communications System and Method
② Flexible disk
③ Patent revenue stamps for transmittal fee and search fee
④ Certificate of payment of international filing fee
⑤ OSUGA, Yoshiyuki　　(Seal)